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ADAPTING THE A2C2 EXPERIMENT FOR USE WITH MTWS

by

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ADPATING THE A2C2 EXPERIMENT FOR USE WITH MTWS

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ABSTRACT

The goals of the Office of Naval Research sponsored Adaptive Architectures for Command and Control (A2C2) research project are to study current and future joint command and control (C2) issues and develop theories about adaptive C2 architectures. The project includes three tiers of model-based human-in-the-loop experiments ranging from ones using simple, highly abstract computer-based simulations (Tier I), through more complex, realistic simulations (Tier II), to involvement in wargames and operational experiments (Tier III). Three Tier I experiments have been conducted to date, and a fourth is in planning. All have employed the Distributed Dynamic Decisionmaking III simulation, developed for this type of experiment, and all have involved variants of the same amphibious scenario. The purpose of this thesis is to help the A2C2 research team prepare for Tier II experiments. The target platform for Tier II is the Marine Air Ground Task Force (MAGTF) Tactical Warfare Simulator (MTWS), a detailed and highly realistic stochastic simulation designed to train decision-makers. The author investigated the degree to which Tier I techniques and procedures can be transitioned to Tier II/ MTWS by adapting the A2C2 scenario to the MTWS environment. This thesis also discusses extracting experimental data from MTWS.

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EXECUTIVE SUMMARY

The goals of the Office of Naval Research sponsored Adaptive Architectures for Command and Control (A2C2) research project are to study current and future joint command and control (C2) issues and develop theories about adaptive C2 architectures. Participants in the A2C2 project include representatives from ALPHATECH Inc., APTIMA Inc., University of Connecticut, George Mason University, Carnegie-Mellon University, Michigan State University, and the Naval Postgraduate School.

The project includes three tiers of model-based human-in-the-loop experiments ranging from ones using simple, highly abstract computer-based simulations (Tier I), through more complex, realistic simulations (Tier II), to involvement in wargames and operational experiments (Tier III). Three Tier I experiments have been conducted to date, and a fourth is in planning. The A2C2 project is designed around a model-experiment-model concept, which is an iterative process that bases the structure and hypotheses of future experiments around the results of previous experiments.

Tier I studies have been conducted at the Naval Postgraduate School since March 1996, and have involved officer-students from several curricula. Tier I studies are conducted on a wargame-like simulation called Distributed Dynamic Decisionmaking (DDD) III that was modified

specifically for the A2C2 experiment. In Tier I experiments, each player acts as the Decision-maker, staff, and computer operator.

In addition to further Tier I testing, the next phase of the A2C2 project involves initiation of Tier II experiments. The target platform for Tier II experiments is the Marine Air Ground Task Force (MAGTF) Tactical Warfare Simulator (MTWS), which is a detailed, realistic, stochastic simulation designed to train decision-makers.

The basic scenario used in the Tier I experiments will be the foundation for the scenarios to be used in the initial Tier II experiments. Because of this, studies must be performed to examine the feasibility of implementing Tier I scenarios on MTWS. Additionally, while later Tier II experiments may have dedicated and trained MTWS operators (so the decision-makers do not have to bear the burden of learning and operating the simulation) the initial experiments in MTWS will likely mirror the Tier I experiments in the sense that the subjects of the experiment will also be the computer operators for the simulation. This means that steps need to be taken to simplify certain procedures in MTWS, to accommodate players who may have little to no experience with MTWS. Finally, since the simulation will change, and the complexity of the experiment will increase during this transition, some of the methods used to extract data from the computer will be different.

Techniques for data extraction from MTWS will need to be established prior to Tier II experimentation.

The purpose of this thesis will be to facilitate the transition of the A2C2 research from Tier I to Tier II by demonstrating how the scenario used in DDD III can be developed in MTWS. This thesis covers four major areas. The first demonstrates how a working version of the A2C2 scenario can be developed using modular approach based on text based batch files, while the second area describes how the simulation would be played in an experiment. The next area discusses possible methods for data extraction from MTWS, and the final section discusses the tradeoffs that must occur in the transition from DDD to MTWS, including a comparison of specific issues pertaining to each simulation.

I. INTRODUCTION

"The Adaptive Architectures for Command and Control (A2C2) research program is a multi-year, multidisciplinary effort to: (1) establish a body of knowledge in current and future joint command and control, and (2) develop and test theories of adaptive architectures. A guiding principle of the A2C2 program is that a practical knowledge of the interactions between the organizational and task (mission) structures is a precursor to the design of flexible organizations." [Ref 5].

A2C2 is an Office of Naval Research (ONR) funded project, and involves research and representatives from ALPHATECH Inc., APTIMA Inc., University of Connecticut, George Mason University, Carnegie-Mellon University, Michigan State University, and the Naval Postgraduate School.

A. BACKGROUND

A2C2 plans envision three tiers of human-in-the-loop experiments that will fulfill the overall objectives of the A2C2 program. Tier I, the first phase of experimentation, involves controlled experiments with officer-students at the Naval Postgraduate School playing the roles of Joint Task Force (JTF) decision-makers. Tier I uses the Distributed

Dynamic Decisionmaking (DDD) III simulation, which was specifically modified for use in A2C2. Tier I experiments are highly abstract with each human player acting as a decision-maker, staff, and the computer operator. Tier II experiments are similar to Tier I, but will use a more realistic model for the simulation, and will expand on the experimental data and hypotheses generated in Tier I experiments. Finally, Tier III experiments will transition the A2C2 project from simple exercises involving officer-students to wargames and operational exercises that may involve an actual JTF commander and the forces and assets that would be used in a real-world military operation.

An overall goal of the A2C2 project is to eventually transition its findings to actual military operations. This is partially done throughout the project using an iterative approach designed around a model-experiment-model concept that exists within and between each tier of experimentation. The results and data collected from each experiment conducted at the Tier I level will likely affect changes in following experiments. Additionally, findings from Tier II and Tier III experiments may prompt further Tier I testing.

B. CURRENT STATUS

To date, three experiments have been conducted at the Naval Postgraduate School, all at the Tier I level. The DDD was used to simulate a Joint Task Force (JTF) conducting an

amphibious assault. Each experiment was conducted using officer-students at NPS as the decision-makers, and was planned and conducted by A2C2 researchers with assistance from students who had participated in prior experiments. The most recent was Experiment 3, conducted at NPS in November of 1997.

1. Experiments 1 and 2

Experiment 1 was conducted in March of 1996. The objective of Experiment 1 was to evaluate the basic experimental techniques for Tier I, and to gather an initial set of data. Experiment 1 explored the issues associated with resource conflicts between two and three level command hierarchies. [Ref. 1].

Experiment 2 was conducted in November of 1996, and built on the results of Experiment 1. In addition, it began looking at architectural adaptation, examining the effect of changes in mission, diversion of forces, and as the actions of enemy forces. [Ref. 1].

2. Experiment 3

Experiment 3 is discussed here in more detail because this experiment is also being used, in part, as the basis to begin the Tier II experiments.

Fifty-four military officers (O-3 to O-4) in the Joint Command, Control, Computers and Intelligence, and Management Sciences curricula were assigned to six-person

teams representative of a Joint Task Force command structure. [Ref. 5].

"Nine teams responded to an initial scenario that simulated an amphibious assault mission in a six-node architecture. A trigger event was then introduced that involved the loss of approximately 30 percent of the available assets. At the end of a planning session teams were asked to choose from one of three architectures: (1) their former, six-node architecture with reduced assets, (2) a five-node architecture, that was similar to their original architecture, with assets somewhat better distributed for the mission, or (3) an 'optimal' four-node architecture, quite different from their original architecture, with assets specifically distributed for the mission's tasks. Each team then engaged in two additional scenarios, one in the architecture they choose and one in another, in a counter-balanced design." [Ref. 5].

Experiment 3 evaluates the same issues as the previous experiments, as well as some new ones. The primary hypothesis investigated in Experiment 3 was that in a situation where teams are forced to adapt their structure, given a choice, they will choose the architecture that most closely resembles the one that they are most recently familiar with rather than the one that is most suitable for the situation (proximity vs. optimality). [Ref. 1].

Preliminary results of Experiment 3 supported the initial hypothesis, but also brought some other issues to light. The data collected confirmed that some level of "learning" was occurring in each successive trial. This means that the teams and individual players become more familiar with the scenario and simulation causing a slight performance increase in each trial, which is independent of the architecture used. [Ref. 1]. Normally, due to counterbalancing, learning is not a problem, but in this case, the possibility exists that it reflects, in part, inadequate mastery of certain skills required in some architectures, but not others. If so, it may have influenced players' choices. The results of Experiment 3, including the learning result, will be used to develop Experiment 4, which is scheduled for the summer of 1998.

C. TRANSITIONING TO MTWS

"The context in which we study architectural adaptation is Joint command and control, or more precisely the Joint Task Force (JTF) command staff. It is therefore essential to make sure that the architectural forms emerging from the basic research effort, and tested in experiments, have a certain degree of face validity. The conduct of officers-in-the-loop experiments at NPS, the progressive evolution from Tier I (DDD) to Tier II (MTWS) experimentation have been

designed to achieve this transition, while maintaining a rigorous scientific approach. " [Ref 6].

In addition to further Tier I testing, the next phase of the A2C2 experiment is the transition to Tier II. The most likely candidate for the Tier II experimentation is the MTWS simulation. This transition is a likely to be complicated process. The basic scenario used in DDD will be the basis for the scenarios that will be used in the initial Tier II experiments. Because of this, feasibility studies need to be performed that verify MTWS' suitability to the task. Additionally, while later Tier II experiments may have dedicated, and highly trained MTWS operators (so the decision-makers do not have to bear the burden of learning and operating the simulation) the initial experiments in MTWS will likely mirror the Tier I experiments in the sense that the subjects of the experiment will also be the computer operators for the simulation. This means that steps need to be taken to simplify certain procedures in MTWS, to ensure that it can accommodate players who will most likely have little to no experience with MTWS. Finally, since the simulation will increase the realism and complexity of the experiment and since MTWS data collection processes are different from DDD's, methods used to collect data will have to change. Techniques for data extraction from MTWS will need to be established prior to Tier II experimentation.

The purpose of this thesis will be to facilitate and explore this transition. A2C2 Experiment 3 is the model used for scenario development in MTWS. This is done in four major segments: MTWS scenario development, execution, data extraction, and evaluation.

The remainder of this thesis, starting with Chapter II, explores the methodology used to build the A2C2 scenario in MTWS. This will primarily be done by using text based batch files that, when used in a modular approach, make the building and modification of the various architectures used in Experiment 3 a simpler process. The process of configuring MTWS workstations for use in the A2C2 scenario is discussed in Chapter III. Chapter IV evaluates the actual gameplay of the scenario in MTWS and the issues that needed to be confronted to overcome the complexity of the MTWS interface. An overview of possible data extraction schemes is provided in Chapter V. As part of the transition process, Chapter VI highlights some of the differences between MTWS and DDD in terms of issues that are important to the A2C2 experiment, and finally, Chapter VII provides recommendations and conclusions to continue this transition.

D. TERMINOLOGY

Certain terminology used in this document has specific meanings that should be clarified to avoid confusion.

1. Forces

The terms blue and red forces generally refer to friendly and enemy forces respectively. Blue forces, in the context of this document and the A2C2 experiment also refer to the forces that will be manipulated by the participants of the experiment.

2. Simulation vs. Scenario

Scenario is used to refer to the operational mission that is the focus of the A2C2 experiment. The operation plan of the A2C2 scenario is outlined in detail in Appendix D. Simulation refers to the specific implementation of the A2C2 scenario in MTWS.

3. Players

Players, in this document refers to the individuals who are participating as subjects in the A2C2 experiment. Operators are the individuals who actually operate the terminals. The simulation was developed so the participants could act as both players and operators, even though this is not necessary. Chapter V discusses this in more detail.

4. MTWS Terms

MTWS Station Control (MSC) refers to the computer that is acting as the primary server for the MTWS simulation. MTWS Display Stations (MDS) are the individual computers in the MTWS network that provide the actual interface for the game players.

5. MTWS Instructions

During the course of this document, there are often references to specific windows and menu operations. A window is referenced by its title which appears in the center of the very top of the window. MTWS contains many menu options nested inside other menus. When referencing multiple menu operations, the notation MENU->SUBMENU1->SUBMENU2->OPTION means that the option or function that is referenced is actually two menus deep. Certain files on the MTWS server are often listed in this document. When they are mentioned directly in the text, they will appear in quotes.

II. BUILDING THE MTWS SCENARIO

This section will explain the initial steps required to launch MTWS, create and start a new scenario and use batch files. It is assumed that the reader has been exposed to MTWS or has MTWS reference materials available. Batch files allow MTWS commands to be issued from a file. Some are used in examples, but a complete listing of batch files used in this thesis and their contents is located in Appendix A. MTWS source materials, such as the MTWS Training Handbooks, [Ref. 4]. provide more detail on the specifics of MTWS commands and are available in the Systems Technology Lab (STL).

A. CREATING AND INITIALIZING THE NEW SCENARIO

After initializing MTWS, as described in Appendix F, select the CREATE option using the computer configured as the MTWS System Controller (MSC). This option is available in the MTWS Systems Operations window under the Exercise Control menu, in the DATABASE-> EXERCISE submenu. The window that pops up as a result of the CREATE command contains several critical options. The new scenario must be given a unique name (one that doesn't exist locally on the MTWS network), a start time is specified if needed, and a user defined parametric database is selected. Since the A2C2 experiment has special requirements, a previously

modified version of the MTWS parametric database created specifically for the A2C2 experiment must be selected. Details of creating and modifying the parametric database appear at the end of this chapter. Select USER DEFINED from the list of options, and another window will open that lists the available customized databases. Select the appropriate database. For this experiment select the database called A2C2_DATA. The user defined parametric database must be defined and saved before the scenario is created. Anytime modifications are made to the parametric database the scenario must be created again. Each time a scenario is created, it makes its own copy of the parametric database. No topographic data is specified for the A2C2 scenario, because in this implementation of the scenario, a flat earth model is used.

The scenario start date and time is user selectable, and should be considered carefully. Once the start time has been selected, the system clock can only be moved ahead, never backwards. It is important to know the system time because many of the batch files used in the scenario to automate the actions of the red forces are triggered at a specific time; they will not execute until the specified time occurs in the scenario. The new exercise can now be loaded using the LOAD option. The parametric database will load, and the system clock will be set to the selected start time.

The next steps create both the artificial and natural terrain features and then the friendly and enemy units used in the scenario. The items created can be added to the scenario in one of two ways: direct changes to the scenario or batch files.

1. Direct Changes

The first method of building or modifying an exercise involves loading the scenario and then modifying the scenario by manually issuing commands through they keyboard. Once the desired units and assets are in place, issue the SAVE option under the same submenu as the LOAD command. Because of the requirements of the A2C2 experiment, this method is not the best method. A unique scenario would have to be created for each architecture used, a time consuming and error prone process.

2. Creating Batch Files

MTWS has a powerful scripting utility that allows a user to easily create batch files that can contain commands within the file to set up a scenario or automate the simulation. Invoking the file name causes these commands to be executed. This is the recommended method for building scenarios for the A2C2 experiment. Since the A2C2 experiment requires as many as six architectures, and all the architectures bear some similarities to the others, it makes sense to use a modular approach to building these scenarios. For each unit needed in an architecture, a

unique batch file is created that will automatically define this unit. If similar units are required for other players, or multiples of the same unit are needed for one player, the initial batch file can simply be copied and modified to reflect the characteristics of the new unit.

B. WORKING WITH BATCH FILES

This section describes how batch files are used to build an MTWS scenario. The use of batch files is especially useful for the A2C2 application because of the ease with which custom scenarios can be built around the core mission described in the experiment. Because of the large number of files required for this experiment, it is important to have a comprehensive batch file naming convention to avoid confusion. The following examples show how batch files are built and how each one is named.

1. Batch File Names

lists a sample set of batch files containing complete MTWS commands that, when invoked, create the infantry units required for the scenario. The remainder of this section describes the batch file naming convention used in A2C2. The following section describes how to build batch files. The first batch file on the list is "a2c2_p4_inf1_p4_lha1." The a2c2 prefix is included in all the batch files that were used to develop this scenario in order to distinguish them from the hundreds of other miscellaneous files that resided

in the same directory. If desired, the default directory for batch files can be changed by modifying a file called "/mtws/mds/.profile". Edit that file and change the parameter called CE_BATCH_PATH to the desired path.

The second part of the file name is p4. This space is reserved for the owner of the unit, in this case, p4, or Player 4. There are six possible players in the A2C2 scenario, p0-p5. The third part of the filename is inf2. This refers to p4's second infantry unit. Note that in , p2 also has an inf2. During simulation play, unit names will include the player number as a prefix so they can be easily distinguished. Finally, the last 2 parts of the filename are p4_lha1. This simply indicates the initial position of the infantry unit, in this case on player 4's LHA. If a unit's initial position is not located on another asset, no location will be specified in the batch file name. For instance, if a unit were to be placed in the field, its batch file name would be "a2c2_p4_inf2."

Since the unit's initial position is located on another asset (LHA1), it is important that the file defining player 4's LHA is defined and invoked prior to the infantry unit's creation. The batch file "a2c2_p4_lha1" must be invoked before "a2c2_p4_inf2_p4_lha1". In some architectures, Player 4 requires another infantry unit to be placed on the same ship. The file "a2c2_p4_inf1_p4_lha1" is then copied to a new file called "a2c2_p4_inf2_p4_lha1." The contents

of the new file need to be modified as well. In this case all the instances of inf1 would need to be changed to inf2. This illustrates how easily and accurately similar units can be created when compared with the tedious manual method.

```
a2c2_p4_inf2_p4_lha1
a2c2_p4_inf2_p2_lpd1
a2c2_p4_inf1_p4_lha1
a2c2_p4_inf1_p2_lpd1
a2c2_p3_inf5_p2_lha1
a2c2_p3_inf4_p2_lha1
a2c2_p3_inf3_p2_lpd1
a2c2_p3_inf2_p2_lpd1
a2c2_p3_inf1_p3_lpd1
a2c2_p3_inf1_p2_lpd1
a2c2_p2_inf1_p2_lha1
```

Figure 1. Sample list of batch files to create units.

The examples listed so far are for defining units. These types of batch files are only used once, at the time the simulation is loaded. Certain other batch files will be used by players while a trial is in progress. These batch files will usually used to automate tasks in MTWS that would be too complicated or time consuming for an A2C2 player to input manually. These include such tasks as launching an air mission, or transporting infantry units from ship to shore. The names of these types of batch file start with a word that indicates their function followed by additional information that describes the players that control the assets and the unit identification. Figure 2 shows a listing of batch files for creating and launching various Close Air Support (CAS) units. The first line is the name

of the file that would launch player one's first CAS unit, which is called P1_CAS1.

```
a2c2_launch_p1_cas1
a2c2_launch_p3_cas1
a2c2_launch_p4_cas1
a2c2_launch_p4_cas2
a2c2_launch_p5_cas1
```

Figure 2. Sample batch files to be used by players.

2. Recording a Batch File

Batch files are assigned to the MTWS Display Station (MDS) that creates them. The LOG menu item located at the top of the Command Entry window is used for recording and saving batch files. The OPEN command is selected under this menu, in order to start MTWS recording commands. MTWS will prompt the user for a unique filename. Since the technique used to develop the MTWS scenario requires such a large number of batch files, it is wise to adhere to the naming convention, such as the one outlined in the previous section and shown in and Figure 2. Appendix A contains complete listings of all names and contents of batch files used in this particular A2C2 scenario.

Once a log file has been opened, MTWS will append every successful command issued on the MDS that opened the log file into that batch file. If a command is rejected for any reason, it will not be stored in the batch file. Additionally, only commands issued in the Command Entry

Window for that MDS will be logged. Adjustments to the map settings or any other windows will not be recorded.

Once the batch file is complete, the user can select the CLOSE option from under the LOG menu. When this process is completed, the resulting batch file is stored in the /mtws/db/cmd_entry/batch/ directory. Figure 3 shows an example of the contents of a batch file. The following sections will explain how various types of MTWS batch files are constructed and structured.

```
CE;CONSTRUCT;RD1;;;IMPROVED_SURFACE;ROAD;ASPHLT-2-LANE;{1352SEQ325127;
52SEQ324121;52SEQ317117;52SEQ309120;52SEQ305117;52SEQ303114;52SEQ292105;
52SEQ269104;52SEQ263102;52SEQ255087;52SEQ222069;52SEQ219066;52SEQ210026;}$
CE;CREATE;HILL;NATURAL_TERRAIN;MOUNTAIN;MOUNTAIN;{0652SEQ284126;52SEQ276122;
52SEQ275115;52SEQ284111;52SEQ294116;52SEQ292125;}$
CE;CREATE;PORT;STRUCTURE;PORT-FACILITY;52SEQ315116;15;40;100;$
```

Figure 3. Contents of a batch file.

a) Creating Terrain

Actual Digital Terrain Elevation Data (DTED) can be used in MTWS, but for the purposes of the A2C2 experiment, it is not implemented since the geographical layout in the scenario is mostly fictitious. The elevation data would not necessarily be consistent with the terrain features created specifically for this A2C2 scenario and could cause confusion for the players.

Figure 4 shows an approximate layout that was used for the A2C2 scenario. Once an appropriate geographical setting has been selected, the MTWS user can start creating terrain features. The interface for creating terrain is the

same interface used to manipulate units and create missions. All the commands and options to create man-made or natural terrain features are located under the CE-CREATE and CE-CONSTRUCT menu items under the command menu. The CE-CREATE function is generally used to create natural terrain features, such as rivers and hills, while the CE-CONSTRUCT option can also build other features such as roads or obstacles, such as minefields or antitank ditches. If an existing unit is specified in the CE-CONSTRUCT command then MTWS will simulate the actual construction process.

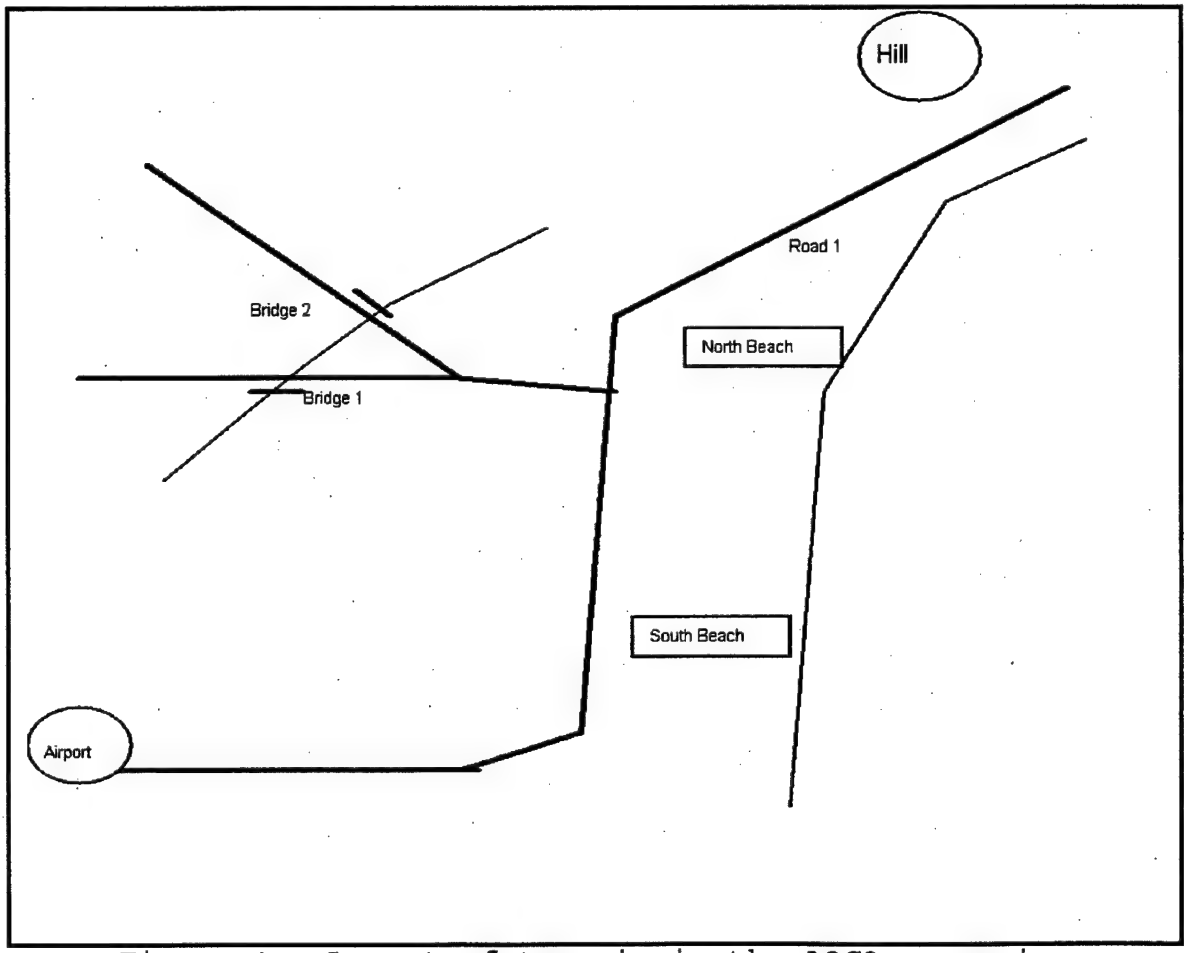


Figure 4. Layout of terrain in the A2C2 scenario.

To create Road 1, as shown in Figure 4, the CE-CONSTRUCT command is selected. The resulting dialog box includes the object name, RD1. Several optional parameters are listed for this command, and in this particular case, these parameters were left blank. The next option is the selection of the type of structure that is to be constructed. In this case, IMPROVED SURFACE was chosen, the type was selected as ROAD, and the sub category was chosen as ASPHLT-2-LN. The final option was to select the sequence of points that the road is to follow. These coordinate values could be manually entered, but the most efficient way is to enter these values by clicking the cursor on the map window at the desired location. Once the points for the road have been selected, the user presses the transmit button, the command is processed, and the entry, shown in Figure 5, is made in the log file.

In the batch file structure, a semicolon separates each option that was input by the user. In the case of optional fields that were left blank, a semicolon is still inserted in the batch file to act as a place holder for that particular option. The options that are shown in the file are exactly as they appeared in the dialog box. Thirteen points for RD1 are listed in this box using MTWS' coordinate system. Since multiple points could be selected for the road location, these points appear inside brackets. The very first point is prefixed by the number 13. This is to

tell MTWS that thirteen data points follow. When editing batch files manually, it is very important to make sure this prefix represents the actual number of data points. For example, the user may have decided to take out a certain bend in the road by removing two points. The 13 must be reduced to 11 to account for the points that have been removed. Many commands in MTWS treat multiple data points using this convention, including flight routes, unit asset updates, and ground troop movements and missions. Since a single batch file command usually takes up multiple lines of text, the end of the command is denoted by a "$".

```
CE;CONSTRUCT;RD1;;;IMPROVED_SURFACE;ROAD;ASPHLT-2-LANE;{1352SEQ325127;
52SEQ324121;52SEQ317117;52SEQ309120;52SEQ305117;52SEQ303114;52SEQ292105;
52SEQ269104;52SEQ263102;52SEQ255087;52SEQ222069;52SEQ219066;52SEQ210026;}$
```

Figure 5. Log of a CE-CONSTRUCT command to create a road.

Since the terrain features in this A2C2 experiment are unchanged between the different trials, are the terrain commands were created in one large batch file called "a2c2_create_terrain."

b) Creating Units

A similar process is used to create ground, sea, and air units. From the Command Entry Window, the Ground-Unit-Define menu option is chosen. The user is prompted for information regarding the unit, including whether they want to use the Table of Organization and Table of Equipment (TO/TE) database that is included with MTWS. The TO/TE

database includes predefined unit asset listings for various friendly and enemy units at all levels of command. In the case of the blue forces in this experiment, the TO/TE is almost always used. The command to create an infantry unit that is used in this scenario would be logged in a batch file as shown in Figure 6.

```
UNIT;DEFINE;P4_INF2;LF;INFANTRY;PLATOON;P4_LHA1;MANCON_5;;SIMULATED;FALSE;
YES;USMC;IFY_3;$
```

Figure 6. Sample batch file created from a command to define an infantry unit.

This batch file is the contents of the first file listed in . Like the example file that defined a road, each option is separated by a semicolon. If this file is used as the basis for other batch files that create infantry units, the parameters that must be changed are P4_INF2 (name), P4_LHA1 (location), and MANCON_5 (controller). The location in this case is a ship, but map coordinates can also be used in this field. The eighth parameter in the batch file in Figure 6, is MANCON_5. This parameter is the controller assigned to the unit. In this experiment, each player is assigned a specific controller. MANCON_1 through MANCON_6 are the controllers for players 0 through 5. The controller(s) assigned to a specific player will determine which unit-specific information is directed to each player. If a player controls P2_INF1, this infantry unit will need to be assigned to MANCON_3. Any computer generated reports

regarding P2_INF1 will be directed to all stations that have been assigned MANCON_3 as a controller. This will be discussed in greater detail in Chapter III.

c) Predefining Air Missions

Individual aircraft are not considered units in MTWS. Rather, they are assets that may be allocated to a particular air squadron. To ensure that an air mission can be executed during an MTWS scenario, several things must occur first. An air squadron as well as fuel and support squadrons need to be defined and positioned where the airfield is to be located. These are all defined using the GROUND->UNIT->DEFINE under the COMMAND menu option in the Command Entry window. For the sake of simplicity in this experiment, the same squadron is used for the air support and air fuel squadrons. Ordinance loads also need to be defined using the AIR->ORDINANCE LOAD->DEFINE menu item. The ordinance loads in MTWS only define a template for the types and amount of ordinance needed for an air mission, and not the actual load itself. Only one ordinance load needs to be defined for each type of armed air mission to be flown. The fuel/supply unit will need enough fuel and weaponry to support all the air missions that will be flown from that location during the trial. Fuel and assets are added using the GROUND->UNIT->UPDATE command. An airfield can now be defined using the COMMAND->AIRFIELD->DEFINE menu

option and filling in the appropriate information. In the A2C2 experiment, all of the friendly airstrips are located on ships. The airfield must have the same name as the ship in order for MTWS to function properly.

Figure 7 shows the batch file that defines an aircraft carrier as well the collocated airfield. In this sample, there are no aircraft defined. Aircraft are allocated using separate batch files. Since the number and type varies with each mission, a batch file has been created for each pair of aircraft to be used.

```
UNIT;DEFINE;P1_CV1;LF;SHIP;COMPANY;52SEQ354037;MANCON_2;;SIMULATED;FALSE;
YES;USN;JFK_CLASS;$
UNIT;DEFINE;P1_CV1_AIRSUPPLY;LF;SUPPLY;COMPANY;P1_CV1;AIRCON;;SIMULATED;
FALSE;YES;USMC;MAT_SUP;$
UNIT;DEFINE;P1_CV1_AIRSQUAD;LF;AIR_SQUADRON;SQUADRON;P1_CV1;AIRCON;;
SIMULATED;FALSE;YES;USMC;VMAAW;$
AIRFIELD;DEFINE;P1_CV1;P1_CV1;OPEN;P1_CV1_AIRSUPPLY;P1_CV1_AIRSUPPLY;
{01P1_CV1_AIRSQUAD;}{00;}$
ASSETS;UPDATE;P1_CV1_AIRSQUAD;ASSET;{04MK-84-BOMB;500;OPERATIONAL;
ZUNI-RKT-4;500;OPERATIONAL;20MM-HE-AC;100000;OPERATIONAL;MAVERICK-TV-MSL;
500;OPERATIONAL;}$
```

Figure 7. Batch file that defines an aircraft carrier and airfield.

In the A2C2 experiment, all combat aircraft are operated in units of two. The batch file "a2c2_p1_cas1" defines and allocates two F18s to the air squadron on the aircraft carrier. While several batch files exist to define CAS aircraft for different players, there is actually no difference in contents of these files. Separate batch files for CAS with distinct file names were created only to

facilitate use by the person who is required to build a specific architecture using these batch files.

Once all the requisite units have been defined, the air missions can be defined. Batch files to launch each aircraft unit were created to ease this process for the players. If Player 4's CAS unit needs to be launched, the batch file called a2c2_launch_p4_cas1 is executed. This file will execute the instruction shown in Figure 8. Note that this air mission is defined with the same name as the unit it represents (P1_CAS1).

Since close air support (CAS) was used in the mission type in Figure 8, a supported unit was required by MTWS for this mission. The unit P5_ENG was used, but any friendly ground unit could have been used here. Setting this option does not preclude the air mission from supporting another ground unit. The last portion of this command, enclosed in brackets, defines the actual route of the air mission. In this case, the purpose is only to launch the aircraft, so a way-point close to the launch site was chosen, and the aircraft was put into a medium orbit. The aircraft will continue to orbit until the player controlling it issues an AIR->MISSION->DIVERT command. Chapter III will discuss, in more detail, how air missions are controlled by the players.

```
AIR_MISSION;DEFINE;P1_CAS1;FA-18;2;P1_CV1_AIRSQUAD;P1_CV1;;;
P5_ENG;CAS;CAS_ORD;;;FALSE;TAKE_OFF;;{0152SEQ334058;MEDIUM;ORBIT;}$
```

Figure 8. Defining an air mission.

d) Ship to Shore

Most of the ground units used in the A2C2 scenario are initially positioned onboard ships. MTWS requires a series of commands to be executed in order to airlift a unit from a ship to a specified location on the ground. This series requires three commands. AIR MISSION->DEFINE, STS->SERIAL->DEFINE, and STS->SERIAL->ASSOCIATE under the COMMAND menu option in the Command Entry window. A serial is a ship to shore operation that involves transport of cargo, assets, or troops. A serial, in this example, is defined in terms of a predefined air mission and an existing ship. This sequence and the example shown in Figure 9, assumes that the prerequisites for an air mission, similar to the one described in the previous section and in Figure 7, have already been met. It also assumes that beaches with landing zones have been defined. In MTWS, a beach is not a terrain item. Instead it is a logical construct used for planning purposes and for defining missions. Because of this, the option to define a beach is located under the STS (ship-to-shore) menu item.

Along with the beaches, checkpoints also need to be defined. Figure 10 shows the batch file to define the beaches and checkpoints. The user is prompted for beach

start points and end points, as well as a line of departure, a causeway, and start and stop points for the underway launch line. Since most of these parameters do not factor heavily into this exercise, but are required for MTWS to accept the BEACH->DEFINE command and to display it on the map. Chapter IV provides an overview on MTWS usage, including how to turn off various display items, including the beach geometries.

When a checkpoint is defined, it must also be specified as a landing zone. To define a serial, a landing zone parameter is required, and the command will not be accepted until a landing zone has been specified. In this scenario, the checkpoints for the two beaches were SB and NB (South and North Beaches), and these are referenced in the SERIAL->DEFINE command shown in Figure 9.

```
AIR_MISSION;DEFINE;LHA_LAND_P2_INF1_SB;MV-22;1;
P2_LHA1_AIRSQUAD;P2_LHA1;;;;STS;TAKE_OFF;;{01SB;MEDIUM;UNIT_DROP;}$
SERIAL;DEFINE;LHA_LAND_P2_INF1_SB;LF;P2_LHA1;USE_OF_AIRCRAFT;{01P2_INF1;}SB;
MV-22;1;$
SERIAL;ASSOCIATE;LHA_LAND_P2_INF1_SB;LHA_LAND_P2_INF1_SB;$
```

Figure 9. Transferring a unit from ship to shore.

```
BEACH;DEFINE;SOUTH_BCH;LF;52SEQ230006;52SEQ245020;;;52SEQ232004;52SEQ249016;
52SEQ237015;{0352SEQ252014;52SEQ236002;52SEQ252004;};;;$
BEACH;DEFINE;NORTH_BCH;LF;52SEQ268065;52SEQ289074;;;52SEQ269061;52SEQ292071;
52SEQ279073;{0352SEQ275060;52SEQ293066;52SEQ289054;};;;$
CHECKPOINT;DEFINE;NB;52SEQ276071;LF;YES;$
CHECKPOINT;DEFINE;SB;52SEQ235012;LF;YES;$
```

Figure 10. Defining a beach.

e) Creating Red Forces

In this exercise, enemy forces are created in a similar manner to blue forces, but are fully automated. In many cases, the automation is a default MTWS behavior. Any unit (including a blue unit) will automatically try to defend itself if threatened or attacked by an opposing force. Ground units can also be defined and put in a defensive posture (which increases their defensive capability) or they can be moved automatically at specific times.

One portion of the exercise requires blue forces to identify trucks moving along two different roads. The trucks are timed to appear in 2-3 minute intervals. This is done by issuing a GROUND->UNIT->MISSION command. Most mission commands give the user an option to specify a start time. These commands are issued with a specific start time and are logged into a batch file. The batch file with these time lagged commands is invoked at the beginning of the scenario, but not executed until the specified time. The sample file in Figure 11 shows the commands that instruct the trucks to start moving at certain times. These times need to be specified relative to the simulated start time of the scenario. If the start time of the exercise is changed, all automated batch files need to be updated as well. MTWS uses the 24 hour time format, referenced to Greenwich Mean Time (GMT) also known as Zulu time. For example,

241914ZFEB98 would 1914 hours (7:14 pm) on 24 February, 1998 in the Greenwich London (Zulu) time zone.

```
UNIT;MISSION;TRK2;MOVE;COLUMN;;MV_PLANS;NO;;;241914ZFEB98;{06RD3;;52SEQ221078;
;RD5;;52SEQ218066;;RD1;;52SEQ210025;;}$
UNIT;MISSION;TRK4;MOVE;COLUMN;;MV_PLANS;NO;;;241917ZFEB98;{06RD3;;52SEQ221078;
;RD5;;52SEQ218066;;RD1;;52SEQ210025;;}$
UNIT;MISSION;TRK5;MOVE;COLUMN;;MV_PLANS;NO;;;241920ZFEB98;{06RD3;;52SEQ221078;
;RD5;;52SEQ218066;;RD1;;52SEQ210025;;}$
UNIT;MISSION;TRK6;MOVE;COLUMN;;MV_PLANS;NO;;;241924ZFEB98;{06RD3;;52SEQ221078;
;RD5;;52SEQ218066;;RD1;;52SEQ210025;;}$
UNIT;MISSION;TRK8;MOVE;COLUMN;;MV_PLANS;NO;;;241927ZFEB98;{06RD3;;52SEQ221078;
;RD5;;52SEQ218066;;RD1;;52SEQ210025;;}$
```

Figure 11. Instructions for automated unit movements.

During the A2C2 scenario, various enemy units, usually artillery, will appear and disappear on the display to simulate enemy movements. This is done to increase pressure on the players and influence their command and control (C2) decision making cycle. This task is easily accomplished by assigning these units missions which move them closer to where blue forces might be located for a few minutes and then moving them away again. Similar procedures can be used to automate enemy and neutral sea and air units. In the scenario, Red forces also deploy both land and sea mines. These minefields are created using the CE->CONSTRUCT menu command. Appendix A provides batch file listings for all the red forces implemented so far.

C. PARAMETRIC DATABASE

The Parametric Database is the portion of MTWS that stores all information regarding unit, vehicle, and weapon characteristics. This database is highly modifiable, and

many traits of current systems and units can be varied to represent new or different capabilities. This is useful for the A2C2 experiment. Although the experiment is designed to simulate a real world amphibious assault, the A2C2 scenario would require too much time and be too complex for the experiment itself. Additionally, blue forces in the experiment have been purposely designed to be stronger than the corresponding red forces. Early loss of key units in this simulation would effectively change the architecture being tested, and therefore would skew the data. Minefields and bridges have also been modified in the parametric database. Once they have been detected, they can be removed in a time efficient manner.

D. OTHER SETTINGS

1. Clock

The simulation has been configured to operate optimally at a time compression factor of 1:1. This is the default setting in MTWS, but the option can be changed in the MTWS Station Control window under the EXERCISE CONTROL->RATE menu option to play at a faster rate, if desired.

2. Mode/State

When the simulation is loaded, the default state is in the ADMIN mode. To start the system clock running, this mode should be changed to RUN, through the EXERCISE CONTROL->OPERATION->STATE menu option in the MTWS Station Control

window. Additionally, the EXERCISE CONTROL->OPERATION->MODE menu option should be set to RESUME if it is currently in SUSPEND mode.

III. PRE-START STATION CONFIGURATION

Each MDS station in MTWS needs to be configured for the appropriate user. Before the MDS stations can be configured, the scenario must be loaded as described in Chapter II. Due to constraints in MTWS, station settings have to be reconfigured each time a new exercise is loaded.

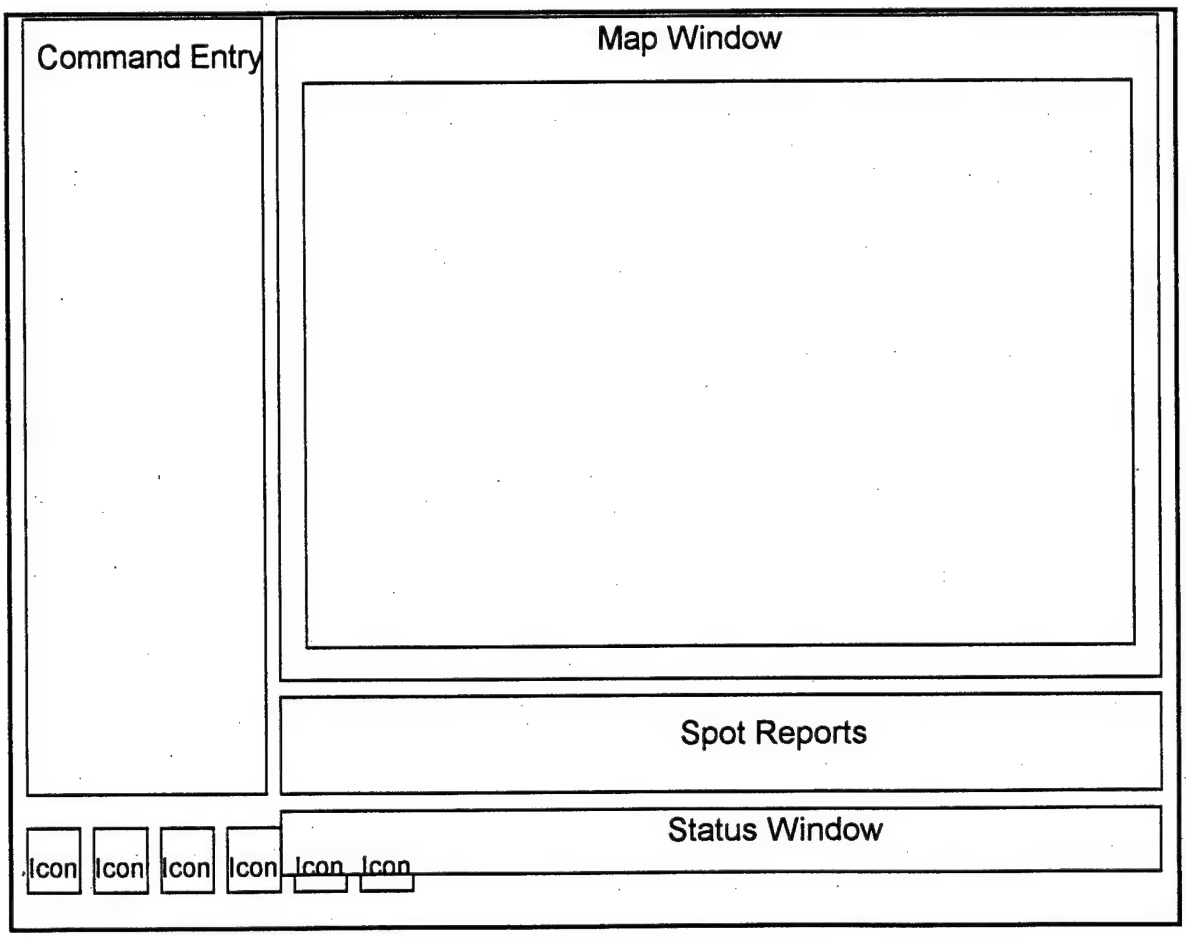


Figure 12. Recommended MTWS Windows Layout.

A. WINDOWS LAYOUT

There are four windows that are essential to playing the scenario in MTWS. The command entry window, the map window, the spot report window, and the status window. Prior to the start of the scenario, these windows need to be sized and positioned so that they are always available to the player. Each window contains vital information or functionality that must be easily available to the player at all times. Figure 12 shows the recommended windows layout for an MDS station.

B. MAP WINDOW SETTINGS

The Display Categories menu item is used to turn certain items and units in MTWS on and off. This menu only contains two options: Display Objects, and Display Environment. This field should not be manipulated by the players. The Display Objects option brings up a window that allows users to vary the types of objects displayed on the map. The only option in this window that needs to be changed from the default settings is under the water category on the button labeled Objects. The user should select the Objects button under this option. Another window will open that lists several features. To make the display less cluttered, the Beach Geometries feature should be turned off.

Under the Display Environment menu option, a window is displayed that allows the user to control which players or forces are displayed on the map window. There are options available for controlled objects (units, ships, aircraft, etc.) and uncontrolled objects (minefields and other obstacles.) In both cases, the red forces (AG) and civilian forces (CIV) should be deselected, so they are not displayed on the map. These objects will only appear on the map windows if they are detected by blue forces. No other options in this window should be modified.

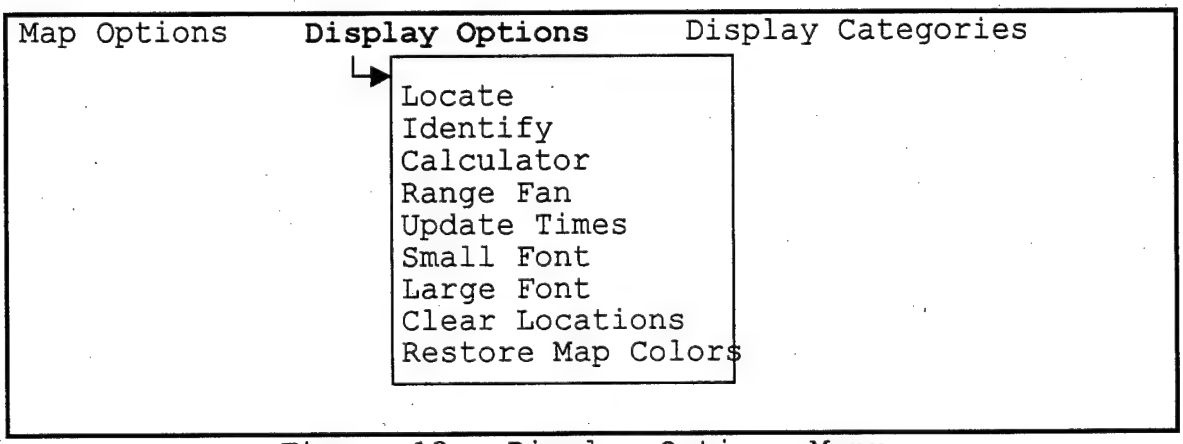


Figure 13. Display Options Menu.

C. CONTROLLER ASSIGNMENTS

Controller assignments are made through the System Operations window which appears as an icon when an MDS station is first launched. Double clicking this icon will display the window. In the A2C2 scenario, each station used in the experiment should only have one controller selected.

To select a controller, the EXERCISE CONTROL menu option is selected, and the ASSIGN/DEASSIGN option is chosen. A window will open with all the possible controllers. If a certain station is to be used for Player 0, then MANCON_1 should be the selected controller. If the station is for Player 1, the MANCON_2 should be selected, and so on. These controller assignment determine who controls units and which messages will appear in the Spot Report windows. It is important that a player is assigned only the necessary controllers so they are not overwhelmed by message traffic that doesn't pertain the their units.

The computer that is configured as the MSC should have all the controllers assigned to it. This will allow the MSC to capture all the spot reports that are generated during the scenario and log them in a file. This is useful for data extraction as discussed in Chapter IV.

D. STATION CONTROL WINDOW

On each MDS station, there is an icon at the bottom of the display called MTWS Station Control. When this icon is double clicked, it opens up the Station Control window. In order for an MDS station to be included in a scenario, the status should be changed from Off Line to On Line. This will register the MDS station on the MTWS network. The privileges a user has over MTWS is determined by the User Privilege Level setting. The lowest setting, zero, only

allows the user to use the functions that are necessary for gameplay. When the privilege level is zero, users can not instantaneously move objects or units, and they cannot change the map display settings, or change controller assignment. Level two is the highest privilege setting and requires a password to be accessed. When an MDS station is being configured, and controllers are being assigned, the privilege level must be set to two. Before the scenario is started however, the level must be returned to zero. Level one is an intermediate level that allows an MTWS controller to have access to certain advanced functions, but not complete control of the scenario. Level one is not necessary for the A2C2 scenario.

IV. PLAYING THE SIMULATION

This chapter is divided into two primary sections. The first section describes actions and commands that will be performed by the players. The second section describes the settings and parameters that need to be modified prior to the start of the scenario by the personnel responsible for administering the experiment.

MTWS is a complex simulation that was originally intended for well-trained and knowledgeable users. Since participants of the A2C2 experiment typically have only limited experience using MTWS, it is useful to provide an outline of the key features and commands they will need to know in order to play the simulation. This chapter provides an overview of commands and instructions the players need to know.

A. FREQUENTLY USED COMMANDS

The MTWS commands used most frequently by the players for this simulation are instructions for ground unit operations and air operations. In the Command Entry window there is a menu option called COMMANDS. This menu item, when selected with the mouse, appears as shown in Figure 14. Since there are dozens of submenus, the items important to the A2C2 simulation will be highlighted in the following

sections. The only commands shown here are the ones that are important to the actual players during gameplay and do not include commands that are used for the creation of the scenario.

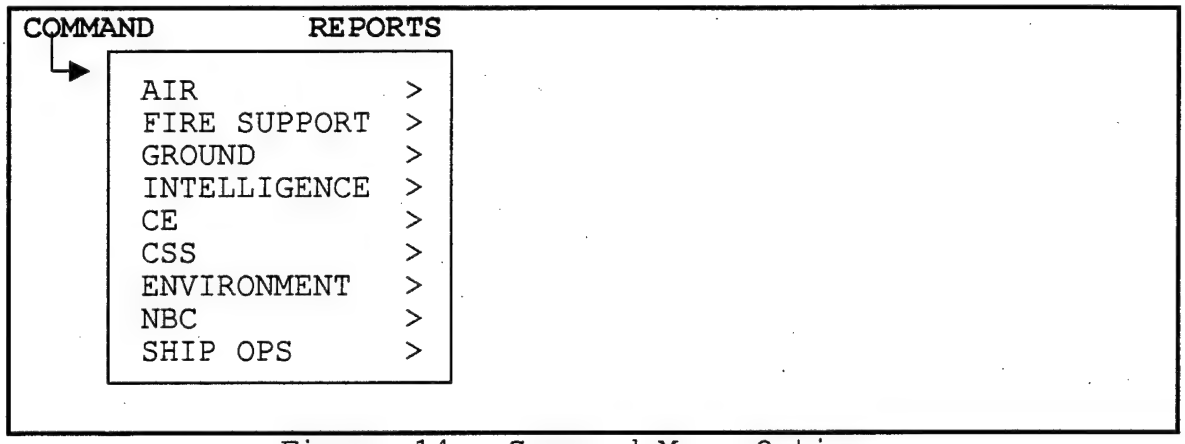


Figure 14. Command Menu Options.

1. Air

AIR->MISSION->DIVERT allows the player to update an air mission that is already launched. This command requires the user to input an existing, and airborne, air mission name, as well as one or more locations. Each point is accompanied by settings for mission type (attack, waypoint, land, orbit etc.) and altitude (very low, low, medium, high). The user should specify the flight profile, and for this experiment, they must specify the last point as an orbit. This prevents the air mission from performing a Return to Base (RTB) automatically. If an air mission RTBs, it will be more than ten minutes of actual time before the simulation allows the aircraft to be launched again. Players should not use this

command to create and launch their own air missions. Instead they should use the batch files that perform this function.

2. STS (Ship to Shore)

This command is not needed by the players. All ship to shore operations are performed through batch files.

3. Fire Support

FIRE SUPPORT->DEFINE QUICK MISSION is used to provide naval gunfire. The quick fire support mission is the most useful for this scenario. It requires only target location information, or the target's name, the name of the firing ship, and the ammunition to be used. The players should have a list of available ammunition from each ship prior to the start of the exercise.

4. Ground

GROUND->UNIT->MISSION specifies actual unit and troop movements on the ground. The more important subcommands included in this command include the functions to MOVE, ATTACK, and DEFEND. There are options in this menu to control speed and to override to the default speed and movement settings for certain terrain. Both speed and movement override should be selected, and a desired speed manually entered. The players should enter a reasonable speed of 30 to 40 kilometers per hour (kph). Like an air mission, a unit mission can involve multiple movements and functions.

5. Intelligence

This command is not used by the players.

6. CE

CE->REMOVE is the only command under this menu that the players will use. Only a player controlling an engineering unit can use this function. In this scenario, CE->REMOVE will be used to remove minefields and bridges.

7. CSS

This command is not used by the players.

8. Environment

This command is not used by the players.

9. NBC

This command is not used by the players.

B. MAP WINDOW FUNCTIONS

The map window provides the primary interface from MTWS to the user. The menu item labeled Map Options is used to manipulate the position and zoom level of the map. The map display in MTWS is capable of displaying any level of detail from the world view down to a detailed level. A player can customize map settings so that the map encompasses only the units they are concerned with. The primary functions under this menu, to be used by the player, are the pan, zoom, and previous map options. The Map Manager feature located under this menu item allows the user to select a map background from a list of various digitized navigational maps, but this

feature is not used for this scenario. Any of these options will be available to players, but the most useful ones will be Identify, and Clear Locations. Identify allows the user to select an area of the screen containing red or blue units, and it will return information about these units, if the information is available. Information includes precise location, unit name, and unit type. This is most useful if players want to launch precision attacks through airborne or naval fire missions. The Clear Locations option cleans markers off the screen. Markers are created anytime a player clicks the mouse on the map area. After a period of time, these marks can significantly clutter the map display.

C. SPOT REPORTS

The Spot Reports window contains textual message traffic that pertains to the units assigned to the active controllers. Section B describes how to assign the active controllers to players and units. Information in the spot report windows is very useful because it is generally updated faster than the map window. Spot reports include pertinent information about a unit, such as enemy target sightings, status of a unit's mission, when a unit attacks or is attacked, as well as damage assessment to that unit. A player will only see spot reports pertaining to units under their control.

V. EXTRACTING DATA FROM MTWS

This chapter will describe how MTWS collects data and highlight some of the possible methods for extracting exercise data from MTWS. There will be no discussion of methods used to analyze these data.

A. LOG FILES

When a scenario is loaded and running, MTWS maintains logs of for all commands that were successfully executed, and a log of all reports that are generated in the Spot Reports window are saved into a file. The files are automatically over-written each time MTWS is restarted. After completing each trial, these files need to be saved to a new location to prevent loss of data. These files are simple text files that can be used to evaluate which tasks were performed when, and how successfully they were executed. [Ref. 3].

1. Command History

The "command.history" file is located in the directory /mtws/db/man/[exercise name]. In the case of this experiment, it would be in the /mtws/db/man/A2C2 directory. This file contains a complete list of all the commands that were executed from the Command Entry window for that particular station. This file includes all the commands

that were executed when the batch files were invoked at the start of the scenario. The data in the "command.history" files are similar to the data that would appear in a batch file. Additionally, these data include the MDS station number of the player that executed the command, and the hour and minute (scenario time) that the command was executed. Figure 15 contains a few sample lines from a "command.history" file.

```
241913ZFEB98;mds005;UNIT;MISSION;P5_SOF;MOVE;VEE;;MV_PLANS;YES;30;OVERRIDE;;{0
352SEQ209088;;52SEQ214083;;52SEQ206076;;}$
241913ZFEB98;mds005;UNIT;MISSION;P5_ENG;MOVE;VEE;;MV_PLANS;YES;30;OVERRIDE;;{0
352SEQ206076;;52SEQ205076;;52SEQ205076;;}$
241914ZFEB98;mds005;UNIT;MISSION;P3_ENG;MOVE;VEE;;MV_PLANS;YES;30;OVERRIDE;;{0
152SEQ228100;;}$
241915ZFEB98;mds005;AIR_MISSION;DIVERT;P1_CAS1;{0252SEQ283120;MEDIUM;WAY_POINT
;52SEQ245056;MEDIUM;ORBIT;};$
241916ZFEB98;mds005;UNIT;MISSION;P3_INF2;MOVE;VEE;;MV_PLANS;YES;30;NO_OVERRIDE
;;{0152SEQ229025;;}$
241916ZFEB98;mds005;UNIT;MISSION;P3_INF3;MOVE;VEE;;MV_PLANS;YES;30;NO_OVERRIDE
;;{0152SEQ229025;;}$
241916ZFEB98;mds005;UNIT;MISSION;P3_INF1;MOVE;VEE;;MV_PLANS;YES;30;NO_OVERRIDE
;;{0152SEQ229025;;}$
241918ZFEB98;mds005;UNIT;MISSION;P3_INF1;MOVE;VEE;;MV_PLANS;YES;30;NO_OVERRIDE
;;{0152SEQ223019;;}$
241919ZFEB98;mds005;UNIT;MISSION;P3_INF1;ATTACK;VEE;;MV_PLANS;YES;30;OVERRIDE;
;{0152SEQ222020;;}$
241919ZFEB98;mds005;UNIT;MISSION;P3_INF2;ATTACK;VEE;;MV_PLANS;YES;30;OVERRIDE;
;{0152SEQ222020;;}$
241919ZFEB98;mds005;UNIT;MISSION;P3_INF3;ATTACK;VEE;;MV_PLANS;YES;30;OVERRIDE;
;{0152SEQ222020;;}$
241920ZFEB98;mds005;AIR_MISSION;DIVERT;P1_CAS1;{0252SEQ223019;VERY_LOW;ATTACK;
52SEQ238030;MEDIUM;ORBIT;}TROOPS;$
```

Figure 15. Sample data from "command.history" file.

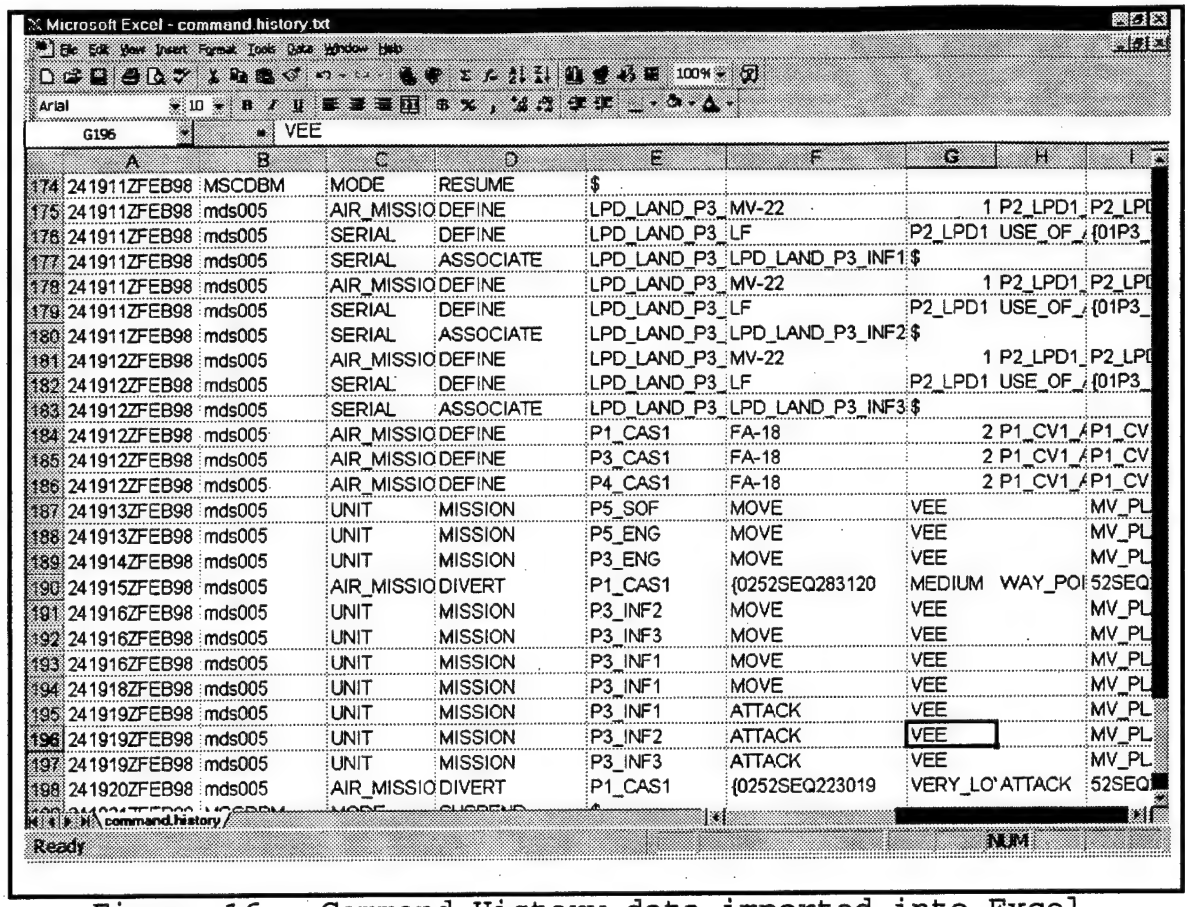
One possible method of extracting data from this file would be to import the text file into a spreadsheet program such as Microsoft Excel. Excel allows a user to parse data into separate cells so it can be managed more easily, or sorted according to the analyst's preference. By studying this reorganized file, it is easy to determine if

coordinated attacks were executed properly. Similarly, the lines of text could be treated as database records and imported into a database program such as Microsoft Access for further data reduction and analysis.

The "command.history" file collects commands from all MDS stations that are on the network into one composite file. This file can be extracted from any MDS.

2. Spot Report Log

The other file that is useful to the data analysis is the spot report log. It is also specific to the MDS. This file is located in the /tmp directory and is called "Spot_Report_Log". This file is a useful complement to the command history file. It contains every spot report that was generated on all the MDS stations. Like the command history file, this data also includes the time each spot report occurred, and which units were involved. Certain spot reports are useful because they quantify the casualties and damage inflicted on units during the simulated combat. The spot reports can be correlated to the commands in the "command.history" file, and the overall effectiveness of a particular task can be assessed in this manner. Figure 17 shows sample output from a spot report log file. The spot reports shown here correspond to the commands shown in Figure 15 and Figure 16.



	A	B	C	D	E	F	G	H	I
174	241911ZFEB98	MSCDBM	MODE	RESUME	$				
175	241911ZFEB98	mds005	AIR_MISSIO	DEFINE	LPD_LAND_P3_	MV-22		1 P2_LPD1_	P2_LPI
176	241911ZFEB98	mds005	SERIAL	DEFINE	LPD_LAND_P3_	LF	P2_LPD1	USE_OF_	{01P3_
177	241911ZFEB98	mds005	SERIAL	ASSOCIATE	LPD_LAND_P3_	LPD_LAND_P3_INF1	$		
178	241911ZFEB98	mds005	AIR_MISSIO	DEFINE	LPD_LAND_P3_	MV-22		1 P2_LPD1_	P2_LPI
179	241911ZFEB98	mds005	SERIAL	DEFINE	LPD_LAND_P3_	LF	P2_LPD1	USE_OF_	{01P3_
180	241911ZFEB98	mds005	SERIAL	ASSOCIATE	LPD_LAND_P3_	LPD_LAND_P3_INF2	$		
181	241912ZFEB98	mds005	AIR_MISSIO	DEFINE	LPD_LAND_P3_	MV-22		1 P2_LPD1_	P2_LPI
182	241912ZFEB98	mds005	SERIAL	DEFINE	LPD_LAND_P3_	LF	P2_LPD1	USE_OF_	{01P3_
183	241912ZFEB98	mds005	SERIAL	ASSOCIATE	LPD_LAND_P3_	LPD_LAND_P3_INF3	$		
184	241912ZFEB98	mds005	AIR_MISSIO	DEFINE	P1_CAS1	FA-18		2 P1_CV1_	P1_CV
185	241912ZFEB98	mds005	AIR_MISSIO	DEFINE	P3_CAS1	FA-18		2 P1_CV1_	P1_CV
186	241912ZFEB98	mds005	AIR_MISSIO	DEFINE	P4_CAS1	FA-18		2 P1_CV1_	P1_CV
187	241913ZFEB98	mds005	UNIT	MISSION	P5_SOF	MOVE	VEE		MV_PL
188	241913ZFEB98	mds005	UNIT	MISSION	P5_ENG	MOVE	VEE		MV_PL
189	241914ZFEB98	mds005	UNIT	MISSION	P3_ENG	MOVE	VEE		MV_PL
190	241915ZFEB98	mds005	AIR_MISSIO	DIVERT	P1_CAS1	{0252SEQ283120	MEDIUM	WAY_POI	52SEQ
191	241916ZFEB98	mds005	UNIT	MISSION	P3_INF2	MOVE	VEE		MV_PL
192	241916ZFEB98	mds005	UNIT	MISSION	P3_INF3	MOVE	VEE		MV_PL
193	241916ZFEB98	mds005	UNIT	MISSION	P3_INF1	MOVE	VEE		MV_PL
194	241918ZFEB98	mds005	UNIT	MISSION	P3_INF1	MOVE	VEE		MV_PL
195	241919ZFEB98	mds005	UNIT	MISSION	P3_INF1	ATTACK	VEE		MV_PL
196	241919ZFEB98	mds005	UNIT	MISSION	P3_INF2	ATTACK	VEE		MV_PL
197	241919ZFEB98	mds005	UNIT	MISSION	P3_INF3	ATTACK	VEE		MV_PL
198	241920ZFEB98	mds005	AIR_MISSIO	DIVERT	P1_CAS1	{0252SEQ223019	VERY_LO	ATTACK	52SEQ

Figure 16. Command History data imported into Excel.

In addition to the data that is collected by the computer, audio and video recordings are routinely made of each A2C2 trial. Additionally, A2C2 analysts also monitor the progress of the trial in real time.

The "Spot_Report_Log" is station specific. As mentioned in Chapter III, all the controllers on the MSC should be activated. This allows the "Spot_Report_Log" file on the MSC to contain all the spot reports that were generated for the entire scenario. This prevents the time consuming process of consolidating separate files.

```
ENGAGEMENT STATUS CHANGE ;P3_INF2;52SEQ224022;241920ZFEB98;MANCON_4;HAS
INITIATED ENGAGEMENT WITH SB_DEFENSE
PRINTED BY: mds005

ENGAGEMENT STATUS CHANGE ;P3_INF3;52SEQ224022;241920ZFEB98;MANCON_4;HAS
INITIATED ENGAGEMENT WITH SB_DEFENSE
PRINTED BY: mds005

STATUS CHANGE;SB_DEFENSE;52SEQ223020;241920ZFEB98;AGCON_1; RECEIVING
AIR-TO-SURFACE FIRE
PRINTED BY: mds005

UNIT SB_DEFENSE; P1_CAS1;TROOPS  1 WIA,
PRINTED BY: mds005

ASSESSMENT REPORT;P5_ENG
AIR_TO_SURFACE;52SEQ206076;241920ZFEB98;MANCON_6;

UNIT SB_DEFENSE; P1_CAS1;TROOPS  1 WIA,
PRINTED BY: mds005

ENGAGEMENT STATUS CHANGE;SB_DEFENSE;52SEQ223020;241921ZFEB98;AGCON_1;IS
ENGAGED BY P3_INF1
PRINTED BY: mds005

ENGAGEMENT STATUS CHANGE;SB_DEFENSE;52SEQ223020;241921ZFEB98;AGCON_1;IS
ENGAGED BY P3_INF2
PRINTED BY: mds005

ENGAGEMENT STATUS CHANGE;SB_DEFENSE;52SEQ223020;241921ZFEB98;AGCON_1;IS
ENGAGED BY P3_INF3
PRINTED BY: mds005

UNIT CASUALTY LIMIT ;SB_DEFENSE;52SEQ223020;241921ZFEB98;AGCON_1;HAS
REACHED EFFECTIVE CASUALTY LIMIT
PRINTED BY: mds005

REPORT; GROUND_ENGAGEMENT  1;52SEQ224021;241921ZFEB98;AGCON_1,MANCON_4;

UNIT SB_DEFENSE; TROOPS  4 WIA,  3 KIA
PRINTED BY: mds005
```

Figure 17. Sample data in spot report log.

B. FUTURE CAPABILITY

The MTWS Analysis and Review System (MARS) is an augmentation to MTWS that is currently under development.

The goal of the MARS system is to provide real time analysis of an exercise as well as an after-action review capability. MARS will require two additional MDS stations to run. [Ref. 2].

VI. EVALUATION

The goal of this chapter is to provide an evaluation of the MTWS scenario in two ways. The first half of the chapter will discuss limitations and concerns that are unique to MTWS. The second half will compare current capabilities of the MTWS version of the scenario to those of the DDD version.

A. MTWS ISSUES

In many ways, MTWS is much less rigidly structured than DDD. MTWS does not force the order of events by requiring prerequisite tasks to be accomplished before players are allowed to continue. In addition, MTWS is stochastic in nature, so even though the specific probabilities of events occurring can be assigned in the parametric database, the outcome of any given event is a random variable. Several additional key issues have been identified that are significantly different between MTWS and DDD.

1. Identification

In DDD, air and sea tracks appear on the display as a question mark until they have been identified. A track can be identified by moving a friendly unit into detection range, and using the IDENTIFY option. MTWS does not allow such a clear cut process for identification. Most units

have sensors or communications with other units that can accomplish this, but unlike the configuration of DDD III used in the A2C2 scenario, the initial detection range units in MTWS does not cover the entire area of operations displayed on the computer screen. Because of this, an unknown track will not appear on the display until it has been detected. Once detected, it appears as a purple rectangle on the display. Even though a unit may be detected, only some or all of the information may be available, including size, type, and alliance of the detected unit. The spot reports displayed in the spot report window will often contain more information than is available on the map display. This process makes target detection and identification a much more complex process in MTWS.

The location of the enemy, in many cases, is known prior to the start of the scenario, so there is no difficulty in identification. The original DDD scenario uses of several "random" tracks that "pop up" and move around the screen. Identifying these tracks in DDD is a relatively simple process for the operator. The random track aspect of the MTWS scenario has not yet been implemented. If the same number of random tracks were used in MTWS, the task of detecting and identifying them would be more difficult and time consuming than DDD. When this feature is implemented in MTWS it should probably use a more

modest number of tracks than DDD in order to keep the scenario playable. Another alternative would be to modify the parametric database to increase the detection ranges of various units or to configure MTWS to simulate a UAV to increase the probability of detection of enemy targets.

2. Combat

In DDD, if some or all of the criteria were met to conduct an assault on the enemy, the enemy unit would automatically be destroyed. However, if the attackers did not have adequate resources or properly time the attack, they would receive a lower score for the task. If the attacking units did not have the necessary resources, the computer would not allow the attack. In DDD friendly units can not be defeated, but the players are penalized in scoring their efficiency instead.

In MTWS, unit composition and assets can be varied greatly. Blue forces can be configured to be substantially stronger or weaker than Red forces, but MTWS will not prevent any attacks the way DDD will. The effectiveness of the attack will be limited by the types of units used and the assets these units contain. Because combat in MTWS is a weighted, but stochastic process, the outcome of any conflict can not be absolutely pre-determined. Approximations were made in determining relative unit strengths for the MTWS scenario, but, with time and

research, a more reliable and predictable balance of strengths between Red and Blue forces could be determined.

B. DDD VS MTWS

There are several issues specific to the A2C2 scenario important to evaluating the performance of architectures. These issues, or factors that directly affect them have been compiled and listed in tabular format in this section. The issues have been divided into two sections.

The first section is a listing of the specific tasks within the scenario that have to be completed by the participants of the A2C2 experiment. This section compares and contrasts any significant differences between MTWS and DDD that might affect or impact the gameplay of the scenario.

The second section is capabilities, and these more general aspects of the A2C2 scenario or tasks that are could be completed at any time such as clearing sea mines. Issues that are more complicated or significantly different from the DDD implementation of the A2C2 experiment are discussed in this section.

1. Tasks

Task: Releasing Assets	
Requirements: A player's assets are not necessarily initially under that player's control. An asset may be located on another asset, such as a ship which is controlled by a second player. The owner of the asset needs to request that second player release, or launch their asset.	
DDD	**MTWS**

The DDD software requires a player to request that the second player release their asset. This request is mandatory in the software, and is usually followed by a verbal request as well. The second player must release the asset using a menu option in the DDD software. The second player is not able to release the asset unless the first player initiated the request through the DDD software.	MTWS does not force this process as does DDD. The launching or releasing assets could by done by anyone, but the procedure forced by DDD should be followed, except that all requests and acknowledgements are only verbal. Since these functions are performed by batch files in MTWS, the process could be enforced by only making batch file names available to the player who is allowed to release the assets.

Task: Landing Amphibious Forces	
Requirements: Players are required to release forces from various sea assets and transport them to the North or South Beaches using MV22s (airborne) and AAAVs (seaborne).	
DDD	**MTWS**
A first player will release a second players MV22 or AAAV using the technique mentioned "Releasing Assets" section above. Once these units have landed at one of the desired locations, the second player will use a menu option to unload the units.	Setting up either an airlift mission or a sea transport is more complicated in MTWS. Batch files were used to automate the process of airlifting units to the North and South beaches. Since batch files would have been used for sealift as well, the processes of sealift and airlift would have been indistinguishable to the players. In the current implementation of the A2C2 scenario, airlift (MV22s) are used for deploying all units to the beaches.

Task: Taking the Beaches	
Requirements: Several players are required to launch a coordinated attack on both the North and South beaches at the same time.	
DDD	**MTWS**
Each player selects the ATTACK option, and selects the desired target, and a	Similar to DDD, each player can issue the commands to launch an attack, but not

confirmation dialog box will appear. Once all the players involved in the coordinated attack have accomplished this, they will all launch their attacks simultaneously. If the coordinated attack did not employ all required platforms, or did not time their attack properly, points will be deducted.	confirm the attack until everyone is ready. Assuming the Blue forces appropriately out-mass the Red forces, the Red forces will be destroyed. If red forces are not destroyed, follow on attacks may be required. If more attacks are required (if too few or inappropriate assets have been used) then Blue forces will suffer more casualties. This information will be logged in the log files generated during the trial. It is up to the analysts to determine a method measuring the success of the attack. While the Blue forces have been configured to be significantly stronger than the Red Forces, the capabilities of both sides will need to be more accurately configured than they are in the current implementation. See Chapter VII for a more detailed summary of this issue.

Task: Removing the Bridge	
Requirements: Blue forces are required to determine which one of two bridges needs to be destroyed by determining which one the enemy is using. This determination is made by identifying an enemy truck heading for the appropriate bridge.	
DDD	**MTWS**
In DDD, a reconnaissance aircraft or a satellite is required to identify if a truck is hostile or neutral. Once this determination has been made, a coordinated attack is required to destroy the bridge.	In MTWS, aircraft can not identify a ground target and display it as a track on the map. Satellites capability is not implemented in MTWS. Ground forces in the area can employ sensor nets or visually identify the trucks. The enemy truck will appear as a company sized unit instead of a team size. The

	amount of time required to remove a bridge in MTWS is directly proportional to the Manpower applied, given that engineering units are used. If all the required units (as outlined in the operational plan) are used, the bridge will be removed in a matter of minutes. If not, it will take significantly longer to remove the bridge.

Task: Taking the Hill	
Requirements: Coordinated attacks are required to capture and hold the hill.	
DDD	**MTWS**
This process is similar to the procedure used to capture the beaches, except the coordinated attack is limited to one enemy unit instead of two. Once the hill has been captured, a unit must hold it by issuing the HOLD command.	The issues here are similar to the issues described for capturing the beaches. MTWS also has the capability to put units into a hold posture after they have defeated red forces.

Task: Taking the Seaport	
Requirements: Coordinated attacks are required to capture the sea port.	
DDD	**MTWS**
This process is similar to the beaches or the hill.	This process is similar to the beaches or the hill.

Task: Taking the Airport	
Requirements: Coordinated attacks are required to capture the airport.	
DDD	**MTWS**
This process is similar to the beaches or the hill.	This process is similar to the beaches or the hill.

2. Capabilities

Capability: Track Identification
Requirements: Players are often required to identify ground, sea, and air tracks to determine whether they are hostile or neutral.

DDD	MTWS
This mission is performed by moving within sensor range to the target in question and issuing an IDENTIFY command. The results of this are then automatically share with all the players.	MTWS will automatically detect a track by displaying a purple rectangle on the screen. The spot report log has to be monitored to identify the type of unit, and whether it is hostile or not. The visual information is shared with all the players, but the spot reports are only displayed for the detecting units.

Capability: Coordinated Attacks	
Requirements: The simulation requires that certain attacks require coordination between Blue forces. If the forces do not have all the capabilities required to accomplish the mission, they will either receive a lower score for the task, or they will not succeed.	
DDD	**MTWS**
This procedure is enforced through the software in DDD. Two or more players will launch an attack as described in the "Taking the Beaches" section. If less than the required forces are applied to the task, DDD will either give a low score or will not allow the task at all.	MTWS will not prevent any unit from attacking another, even with inadequate resources. Attack missions will be far more efficient if the appropriate units are applied. MTWS does not score the results, but the log files can be analyzed to learn the damage inflicted on the enemy unit, and whether the players used the right forces for the job.

Capability: Medivac Missions	
Requirements: Sometimes units sustain casualties after an attack, and a medivac mission is required before the unit is capable to continue operating.	
DDD	**MTWS**
Launching a medivac mission is as simple as releasing a medivac asset. Once this unit is operational, the ATTACK option is used on the wounded unit. The unit is then restored.	MTWS can support medivac missions, but this capability is difficult to employ. Additionally, MTWS requires situation specific information (such as number of wounded and killed) so batch files could not be

	used. This feature is not currently implemented.

Capability: Clearing Sea Mines	
Requirements: Sea mines will likely block access to one or both of the beaches, and need to be cleared before the operation can continue.	
DDD	**MTWS**
DDD will automatically stop a ship from moving into sea mines once they have been detected. DDD will display a mine icon to represent the mines on the screen. A minesweeper needs to be moved into the area, and instructed to remove the mines.	MTWS will allow ships to detect sea mines if the parametric database is properly configured. Otherwise the only way to find them is to run into them. The firepower of the mines can be reduced in the parametric database so the damage to naval assets is not significant. Ships will not stop when they encounter a minefield. The settings in MTWS require an enemy minefield to be displayed all the time or none of the time. Minefields will not be displayed on the screen after detection. No easy method was determined to remove sea mines. The sea mines capability to disarm them was researched, but not implemented.

Capability: Clearing Land Mines	
Requirements: Blue forces will encounter land mines at "random" locations on some of the roads. Once these mines have been detected, and engineering unit is required to remove them.	
DDD	**MTWS**
DDD does not allow players to move around the mines, or through them until they have been removed. An engineering unit simply needs to approach the minefield, and issue the command to remove the mines.	MTWS will stop land units when they encounter a minefield. Unless there are obstructions, (which can easily be put in place), units can move off the road and around the mine field. An engineering unit is required to remove the

	minefield. The amount of time and manpower required to remove a minefield was manipulated in the parametric database, so a minefield could be removed in a reasonable amount of game time.

Capability: Clearing Tanks	
Requirements: Blue forces "randomly" encounter tanks which must be defeated before the mission can proceed.	
DDD	**MTWS**
A coordinated attack is required to remove a tank.	MTWS functions similarly to the other coordinated tasks. The tanks can be configured so they are easily defeated. This was researched, but due to time restraints, not included in the implemented version.

Capability: Clearing SAM Sites	
Requirements: SAM sites must be detected, and determined to be non-decoy or hostile before they can be destroyed. Certain other tasks can not be performed until a nearby SAM site has been destroyed.	
DDD	**MTWS**
DDD will not allow the following on task (such as taking the port) to be accomplished until the SAM site has been destroyed. Coordinated attacks are required to remove the SAM site.	MTWS can not enforce the order of events, so while a SAM site may be present, units can still continue other parts of the mission at increased risk to air assets. MTWS includes SAMs in its database, but this feature has not been implemented yet due to time constraints.

Capability: Removing Pop Up Targets	
Requirements: Various enemy air units appear on the screen from time to time. The units can be removed with a single air unit, or with naval gunfire support	
DDD	**MTWS**
When the target appears, a single aircraft or ship can attack if it is in range.	This feature has not been implemented yet, but could easily be added by including

	timed batch files to move enemy artillery units in and out of range of the Blue forces. These units can be configured to be relatively weak, so they can be destroyed by a ship or a single CAS mission.

Capability: Clearing Hostile Tracks	
Requirements: Random and hostile air, sea, and ground tracks will appear periodically. These units should be identified and then destroyed.	
DDD	**MTWS**
Ships, ground units, and aircraft have the capability to detect some or all of these tracks. Neutral tracks may be destroyed, but it lessens a teams overall score. Most of these tracks can be removed with a single unit.	Time based batch files can be used to automate the random tracks. Units in MTWS can detect a track if it is in sensor range. These automated units, like other Red force units will be configured so they are relatively easy to defeat with the appropriate units.

VII. CONCLUSIONS

A. CONCLUSIONS

This thesis set out to facilitate and explore the transition of the A2C2 project from Tier I experimentation to Tier II experimentation using the MTWS simulation.

Using the method of developing multiple batch files for building the scenario and simplifying the simulation, and the modular approach to building scenarios, MTWS can easily accommodate modifications for subsequent experiments with a minimum of effort. The MTWS simulation will provide an operation that is driven much more by the course of scenario events than it is by aspects of the computer interface. This will provide an accurate assessment of command and control architectures which could be mapped into real-world organizational structures.

MTWS is a viable platform for the continuation of the A2C2 project. Because of its detailed database that can realistically structure every aspect of the game, and its stochastic nature, it can provide much more of the real-world uncertainty that is often referred to as the "fog of war." Yet MTWS can still provide a highly controlled environment that can be used to perform repeatable

experiments that can assess the effectiveness of various command and control architectures.

B. RECCOMMENDATIONS

Although the author has concluded that MTWS can support the A2C2 project, several issues need to be resolved or investigated before the MTWS implementation of the A2C2 scenario is ready for use in the transition from Tier I to Tier II experimentation.

1. Red Forces and Neutral Targets

Virtually all the Blue forces have been implemented in the MTWS, except where noted in Chapter VI. Many of the Red Forces still need to be implemented. These include the hostile and neutral air and sea traffic as well as the pop up artillery units that appear from time to time in the scenario. Additionally, the short comings with enemy sea mine removal should be resolved.

2. Combat

Red and Blue forces have been defined and equipped in MTWS so the outcome of combat will usually be favorable for Blue forces if the appropriate units are applied. The outcome will be closer to a draw if inadequate forces are applied. In the case where inadequate forces are used repeatedly, the attrition rates will most likely eventually eliminate Red Forces.

The probability of victory given the assigned units has not been assessed. Closed loop trials could be run on Red Forces versus Blue Forces to determine the outcome of a large number of engagements. This will help determine a realistic structure for Red and Blue forces so that Blue forces will be forced to fight, with desired attrition rates. It will also help the A2C2 analysts remove the effects of the probabilistic events in MTWS from the performance of the players.

3. Unbiased Controller

MTWS has a certain set of commands and capabilities, that allow an unbiased controller to have complete control over the simulation if necessary. This controller could perform functions such as allowing minefields to be visible after they have been detected, or overriding MTWS in cases where Blue units have been damaged beyond usefulness or killed. The controller could step in any situation where the software or computer equipment have a more significant impact on the outcome of a task or a mission than they should.

4. Dedicated Controllers

The MTWS concept was designed to that the people who were being trained or tested by it did not need to have any knowledge of the MTWS interface itself. Instead, dedicated computer operators would control MTWS workstation and act as an interface between the decision makers and the simulation.

While this method might eliminate the need for MTWS training for A2C2 participants, the addition of dedicated human controllers could present another variable that could impact the results of the experiment. Batch files that are used to automate tasks, as outlined in Chapter IV, could be used to further simplify the usage MTWS and further reduce the complexity for the operators.

5. MARS Capability

The MARS upgrade to MTWS will provide a wide array of analysis tools to the MTWS package. Many of these will automate the task a extracting and analyzing data during a trial as well as after a trial. [Ref. 2].

APPENDIX A. BATCH FILE LISTINGS

This appendix provides a complete listing of batch files and their contents in the current implementation of the A2C2 experiment.

a2c2_trucks_create

```
UNIT;DEFINE;TRK1;CIV;CIVILIAN;TEAM;39DXE110309;CONT_1;;SIMUL
ATED;FALSE;NO;$
UNIT;DEFINE;TRK2;CIV;CIVILIAN;TEAM;39DXE110309;CONT_1;;SIMUL
ATED;FALSE;NO;$
UNIT;DEFINE;TRK3;CIV;CIVILIAN;TEAM;39DXE110309;CONT_1;;SIMUL
ATED;FALSE;NO;$
UNIT;DEFINE;TRK4;CIV;CIVILIAN;TEAM;39DXE110309;CONT_1;;SIMUL
ATED;FALSE;NO;$
UNIT;DEFINE;TRK5;CIV;CIVILIAN;TEAM;39DXE110309;CONT_1;;SIMUL
ATED;FALSE;NO;$
UNIT;DEFINE;TRK6;CIV;CIVILIAN;TEAM;39DXE110309;CONT_1;;SIMUL
ATED;FALSE;NO;$
UNIT;DEFINE;TRK7;CIV;CIVILIAN;TEAM;39DXE110309;CONT_1;;SIMUL
ATED;FALSE;NO;$
UNIT;DEFINE;TRK8;CIV;CIVILIAN;TEAM;39DXE110309;CONT_1;;SIMUL
ATED;FALSE;NO;$
UNIT;DEFINE;TRK9;CIV;CIVILIAN;TEAM;39DXE110309;CONT_1;;SIMUL
ATED;FALSE;NO;$
UNIT;DEFINE;TRK10;CIV;MOTOR_TRANSPORT;SECTION;48DVG209054;AG
CON_1;;SIMULATED;
FALSE;NO;$
ASSETS;UPDATE;TRK1;TROOPS;{012;HEALTHY;}$
ASSETS;UPDATE;TRK2;TROOPS;{012;HEALTHY;}$
ASSETS;UPDATE;TRK3;TROOPS;{012;HEALTHY;}$
ASSETS;UPDATE;TRK4;TROOPS;{012;HEALTHY;}$
ASSETS;UPDATE;TRK5;TROOPS;{012;HEALTHY;}$
ASSETS;UPDATE;TRK6;TROOPS;{012;HEALTHY;}$
ASSETS;UPDATE;TRK7;TROOPS;{012;HEALTHY;}$
ASSETS;UPDATE;TRK8;TROOPS;{012;HEALTHY;}$
ASSETS;UPDATE;TRK9;TROOPS;{012;HEALTHY;}$
ASSETS;UPDATE;TRK10;TROOPS;{012;HEALTHY;}$
ASSETS;UPDATE;TRK1;ASSET;{012.5-TRUCK;1;OPERATIONAL;}$
ASSETS;UPDATE;TRK2;ASSET;{012.5-TRUCK;1;OPERATIONAL;}$
ASSETS;UPDATE;TRK3;ASSET;{012.5-TRUCK;1;OPERATIONAL;}$
ASSETS;UPDATE;TRK4;ASSET;{012.5-TRUCK;1;OPERATIONAL;}$
ASSETS;UPDATE;TRK5;ASSET;{012.5-TRUCK;1;OPERATIONAL;}$
```

```
ASSETS;UPDATE;TRK6;ASSET;{012.5-TRUCK;1;OPERATIONAL;}$
ASSETS;UPDATE;TRK7;ASSET;{012.5-TRUCK;1;OPERATIONAL;}$
ASSETS;UPDATE;TRK8;ASSET;{012.5-TRUCK;1;OPERATIONAL;}$
ASSETS;UPDATE;TRK9;ASSET;{012.5-TRUCK;1;OPERATIONAL;}$
ASSETS;UPDATE;TRK10;ASSET;{012.5-TRUCK;1;OPERATIONAL;}$
ASSETS;UPDATE;TRK1;FUEL;500;$
ASSETS;UPDATE;TRK2;FUEL;500;$
ASSETS;UPDATE;TRK3;FUEL;500;$
ASSETS;UPDATE;TRK4;FUEL;500;$
ASSETS;UPDATE;TRK5;FUEL;500;$
ASSETS;UPDATE;TRK6;FUEL;500;$
ASSETS;UPDATE;TRK7;FUEL;500;$
ASSETS;UPDATE;TRK8;FUEL;500;$
ASSETS;UPDATE;TRK9;FUEL;500;$
ASSETS;UPDATE;TRK10;FUEL;500;$
```

a2c2_run_trucks

```
UNIT;LOCATE;TRK1;52SEQ128119;$
UNIT;LOCATE;TRK3;52SEQ128119;$
UNIT;LOCATE;TRK7;52SEQ128119;$
UNIT;LOCATE;TRK10;52SEQ113127;$
UNIT;MISSION;TRK1;MOVE;COLUMN;;MV_PLANS;NO;;;241913ZFEB98;{0
5RD4;;52SEQ203076;;
RD5;;RD1;;52SEQ210025;;}$
UNIT;MISSION;TRK3;MOVE;COLUMN;;MV_PLANS;NO;;;241917ZFEB98;{0
5RD4;;52SEQ203076;;
RD5;;RD1;;52SEQ210025;;}$
UNIT;MISSION;TRK7;MOVE;COLUMN;;MV_PLANS;NO;;;241917ZFEB98;{0
5RD4;;52SEQ203076;;
RD5;;RD1;;52SEQ210025;;}$
UNIT;MISSION;TRK10;MOVE;COLUMN;;MV_PLANS;NO;;;241928ZFEB98;{
05RD4;;52SEQ203076;
;RD5;;RD1;;52SEQ210025;;}$
UNIT;LOCATE;TRK2;52SEQ233160;$
UNIT;LOCATE;TRK4;52SEQ233160;$
UNIT;LOCATE;TRK5;52SEQ233160;$
UNIT;LOCATE;TRK6;52SEQ233160;$
UNIT;LOCATE;TRK8;52SEQ233160;$
UNIT;LOCATE;TRK9;52SEQ233160;$
UNIT;MISSION;TRK2;MOVE;COLUMN;;MV_PLANS;NO;;;241914ZFEB98;{0
6RD3;;52SEQ221078;;
RD5;;52SEQ218066;;RD1;;52SEQ210025;;}$
UNIT;MISSION;TRK4;MOVE;COLUMN;;MV_PLANS;NO;;;241917ZFEB98;{0
6RD3;;52SEQ221078;;
RD5;;52SEQ218066;;RD1;;52SEQ210025;;}$
UNIT;MISSION;TRK5;MOVE;COLUMN;;MV_PLANS;NO;;;241920ZFEB98;{0
6RD3;;52SEQ221078;;
RD5;;52SEQ218066;;RD1;;52SEQ210025;;}$
UNIT;MISSION;TRK6;MOVE;COLUMN;;MV_PLANS;NO;;;241924ZFEB98;{0
6RD3;;52SEQ221078;;
RD5;;52SEQ218066;;RD1;;52SEQ210025;;}$
```

```
UNIT;MISSION;TRK8;MOVE;COLUMN;;MV_PLANS;NO;;;241927ZFEB98;{0
6RD3;;52SEQ221078;;
RD5;;52SEQ218066;;RD1;;52SEQ210025;;}$
UNIT;MISSION;TRK9;MOVE;COLUMN;;MV_PLANS;NO;;;241929ZFEB98;{0
6RD3;;52SEQ221078;;
RD5;;52SEQ218066;;RD1;;52SEQ210025;;}$
```

a2c2_red_mines

```
CE;CONSTRUCT;MINES;;;OBSTACLE;MINE;AG;M-FLD-AP-
LOW;{0452SEQ206011;52SEQ212004;
52SEQ207002;52SEQ201009;}$
```

a2c2_red_defense

```
UNIT;DEFINE;HILL_DEFENSE;AG;INFANTRY;TEAM;52SEQ285118;AGCON_
1;;SIMULATED;FALSE;NO;$
UNIT;DEFINE;NB_DEFENSE;AG;INFANTRY;TEAM;52SEQ269087;AGCON_1;
;SIMULATED;FALSE;NO;$
UNIT;DEFINE;SB_DEFENSE;AG;INFANTRY;TEAM;52SEQ223020;AGCON_1;
;SIMULATED;FALSE;NO;$
UNIT;DEFINE;PORT_DEFENSE;AG;INFANTRY;TEAM;52SEQ328122;AGCON_
1;;SIMULATED;FALSE;NO;$
UNIT;DEFINE;AIRPORT_DEFENSE;AG;INFANTRY;TEAM;52SEP145983;AGC
ON_1;;SIMULATED;FALSE;NO;$
ASSETS;UPDATE;NB_DEFENSE;TROOPS;{018;HEALTHY;}$
ASSETS;UPDATE;SB_DEFENSE;TROOPS;{018;HEALTHY;}$
ASSETS;UPDATE;AIRPORT_DEFENSE;TROOPS;{018;HEALTHY;}$
ASSETS;UPDATE;HILL_DEFENSE;TROOPS;{018;HEALTHY;}$
ASSETS;UPDATE;PORT_DEFENSE;TROOPS;{018;HEALTHY;}$
ASSETS;UPDATE;SB_DEFENSE;WATER;500;$
ASSETS;UPDATE;NB_DEFENSE;WATER;500;$
ASSETS;UPDATE;HILL_DEFENSE;WATER;500;$
ASSETS;UPDATE;PORT_DEFENSE;WATER;500;$
ASSETS;UPDATE;AIRPORT_DEFENSE;WATER;500;$
ASSETS;UPDATE;NB_DEFENSE;RATIONS;200;$
ASSETS;UPDATE;SB_DEFENSE;RATIONS;200;$
ASSETS;UPDATE;AIRPORT_DEFENSE;RATIONS;200;$
ASSETS;UPDATE;PORT_DEFENSE;RATIONS;200;$
ASSETS;UPDATE;HILL_DEFENSE;RATIONS;200;$
ASSETS;UPDATE;NB_DEFENSE;ASSET;{02M-16;3;OPERATIONAL;SA-
BALL;1000;OPERATIONAL;}$
ASSETS;UPDATE;SB_DEFENSE;ASSET;{02M-16;3;OPERATIONAL;SA-
BALL;1000;OPERATIONAL;}$
ASSETS;UPDATE;AIRPORT_DEFENSE;ASSET;{02M-6;3;OPERATIONAL;SA-
BALL;1000;OPERATIONAL;}$
ASSETS;UPDATE;HILL_DEFENSE;ASSET;{02M-16;3;OPERATIONAL;SA-
BALL;1000;OPERATIONAL;}$
ASSETS;UPDATE;PORT_DEFENSE;ASSET;{02M-16;3;OPERATIONAL;SA-
BALL;1000;OPERATIONAL;}$
```

a2c2_p5_sof

```
UNIT;DEFINE;P5_SOF;LF;ENGINEER;PLATOON;52SEQ217094;MANCON_6;
;SIMULATED;FALSE;YES;USMC;ENG_BRIDGE;$
```

a2c2_p5_eng

```
UNIT;DEFINE;P5_ENG;LF;ENGINEER;COMPANY;52SEQ211081;MANCON_6;
;SIMULATED;FALSE;YES;USMC;CMB_ENG;$
```

a2c2_p5_cas1

```
AIRCRAFT;DEFINE;FA-18;P1_CV1_AIRSQUAD;0002;QUANTITY;2;$
```

a2c2_p4_vf1

```
AIRCRAFT;DEFINE;F-14;P1_CV1_AIR_SQUAD;0001;QUANTITY;2;$
```

a2c2_p4_mv22_p4_lha1

```
AIRCRAFT;DEFINE;MV-22;P4_LHA1_AIRSQUAD;2222;QUANTITY;1;$
```

a2c2_p4_mv22_p2_lpd1

```
AIRCRAFT;DEFINE;MV-22;P2_LPD1_AIRSQUAD;2222;QUANTITY;1;$
```

a2c2_p4_med2_lpd1

```
AIRCRAFT;DEFINE;UH-;P2_LPD1_AIRSQUAD;5555;INDIVIDUAL;{011;}$
```

a2c2_p4_med2_lha1

```
AIRCRAFT;DEFINE;UH-1;P4_LHA1_AIRSQUAD;5555;INDIVIDUAL;
{011;}$
```

a2c2_p4_med1_lha1

```
AIRCRAFT;DEFINE;UH-1;P4_LHA1_AIRSQUAD;5555;INDIVIDUAL;
{011;}$
```

a2c2_p4_lha1

```
UNIT;DEFINE;P4_LHA1;LF;SHIP;COMPANY;52SEQ260000;MANCON_5;;SI
MULATED;FALSE;YES;USN;LHA;$
UNIT;DEFINE;P4_LHA1_AIRSQUAD;LF;AIR_SQUADRON;COMPANY;P4_LHA1
;AIRCON;;SIMULATED;FALSE;YES;USMC;MASS;$
UNIT;DEFINE;P4_LHA1_AIRSUPPLY;LF;SUPPLY;SQUADRON;P4_LHA1;AIR
CON;;SIMULATED;FALSE;NO;$
ASSETS;UPDATE;P4_LHA1_AIRSUPPLY;TROOPS;{0150;HEALTHY;}$
ASSETS;UPDATE;P4_LHA1_AIRSUPPLY;FUEL;1000000;$
ASSETS;UPDATE;P4_LHA1_AIRSUPPLY;RATIONS;5000;$
ASSETS;UPDATE;P4_LHA1_AIRSUPPLY;WATER;50000;$
AIRFIELD;DEFINE;P4_LHA1;P4_LHA1;OPEN;;P4_LHA1_AIRSUPPLY;{01P
4_LHA1_AIRSQUAD;}{00;}$
```

a2c2_p4_inf2_p4_lha1

```
UNIT;DEFINE;P4_INF2;LF;INFANTRY;PLATOON;P4_LHA1;MANCON_5;;SI
MULATED;FALSE;YES;USMC;IFY_3;$
```

a2c2_p4_inf2_p2_lpd1

```
UNIT;DEFINE;P4_INF2;LF;INFANTRY;PLATOON;P2_LPD1;MANCON_5;;SI
MULATED;FALSE;YES;USMC;IFY_3;$
```

a2c2_p4_inf1_p4_lha1

```
UNIT;DEFINE;P4_INF1;LF;INFANTRY;PLATOON;P4_LHA1;MANCON_5;;SI
MULATED;FALSE;YES;
USMC;IFY_3;$
```

a2c2_p4_inf1_p2_lpd1_southbeach

```
AIR_MISSION;DEFINE;LPD_LAND_P4_INF1_SB;MV-
22;1;P2_LPD1_AIRSQUAD;P2_LPD1;;;;STS;
TAKE_OFF;;{01SB;MEDIUM;UNIT_DROP;}$
SERIAL;DEFINE;LPD_LAND_P4_INF1_SB;LF;P2_LPD1;USE_OF_AIRCRAFT
;{01P4_INF1;}SB;
MV-22;1;$
SERIAL;ASSOCIATE;LPD_LAND_P4_INF1_SB;LPD_LAND_P4_INF1_SB;$
```

a2c2_p4_inf1_p2_lpd1_northbeach

```
AIR_MISSION;DEFINE;LPD_LAND_P4_INF1_NB;MV-
22;1;P2_LPD1_AIRSQUAD;P2_LPD1;;;;STS;
TAKE_OFF;;{01NB;MEDIUM;UNIT_DROP;}$
SERIAL;DEFINE;LPD_LAND_P4_INF1_NB;LF;P2_LPD1;USE_OF_AIRCRAFT
;{01P4_INF1;}NB;
MV-22;1;$
SERIAL;ASSOCIATE;LPD_LAND_P4_INF1_NB;LPD_LAND_P4_INF1_NB;$
```

a2c2_p4_inf1_p2_lpd1

```
UNIT;DEFINE;P4_INF1;LF;INFANTRY;PLATOON;P2_LPD1;MANCON_5;;SI
MULATED;FALSE;YES;
USMC;IFY_3;$
```

a2c2_p4_cas2

```
AIRCRAFT;DEFINE;FA-18;P1_CV1_AIRSQUAD;0002;QUANTITY;2;$
```

a2c2_p4_cas1

```
AIRCRAFT;DEFINE;FA-18;P1_CV1_AIRSQUAD;0002;QUANTITY;2;$
```

a2c2_p4_ah1-1_p2_lpd1

```
AIRCRAFT;DEFINE;AH-1W;P2_LPD1_AIRSQUAD;4444;QUANTITY;2;$
AIRCRAFT;DEFINE;AH-1W;P2_LHA1_AIRSQUAD;4444;QUANTITY;2;$
```

a2c2_p4_aaav1_on_p4_lha1

```
UNIT;DEFINE;P4_AAAV1;LF;ASSAULT_AMPHIBIAN;PLATOON;P4_LHA1;MA
NCON_5;;SIMULATED;
FALSE;YES;USMC;AAV;$
```

a2c2_p4_aaav1_on_p2_lha1

```
UNIT;DEFINE;P4_AAAV1;LF;ASSAULT_AMPHIBIAN;PLATOON;P2_LHA1;MA
NCON_5;;SIMULATED;
FALSE;YES;USMC;AAV;$
```

a2c2_p3_vf1

```
AIRCRAFT;DEFINE;F-14;P1_CV1_AIR_SQUAD;0001;QUANTITY;2;$
```

a2c2_p3_sof

```
UNIT;DEFINE;P3_SOF;LF;ENGINEER;PLATOON;52SEQ217094;MANCON_4;
;SIMULATED;FALSE;
YES;USMC;ENG_BRIDGE;$
```

a2c2_p3_mv22b_p3_lpd1

```
AIRCRAFT;DEFINE;MV-22;P3_LPD1_AIRSQUAD;2222;QUANTITY;1;$
```

a2c2_p3_mv22b_p2_lpd1

```
AIRCRAFT;DEFINE;MV-22;P2_LPD1_AIRSQUAD;2222;QUANTITY;1;$
```

a2c2_p3_mv22a_p3_lpd1

```
AIRCRAFT;DEFINE;MV-22;P3_LPD1_AIRSQUAD;2222;QUANTITY;1;$
```

a2c2_p3_mv22a_p2_lpd1

```
AIRCRAFT;DEFINE;MV-22;P2_LPD1_AIRSQUAD;2222;QUANTITY;1;$
```

a2c2_p3_med2_lha1

```
AIRCRAFT;DEFINE;UH-
1;P2_LHA1_AIRSQUAD;5555;INDIVIDUAL;{011;}$
```

a2c2_p3_med1_lpd1

```
AIRCRAFT;DEFINE;UH-
1;P3_LPD1_AIRSQUAD;5555;INDIVIDUAL;{011;}$
```

a2c2_p3_med1_lha1

```
AIRCRAFT;DEFINE;UH-
1;P2_LHA1_AIRSQUAD;5555;INDIVIDUAL;{011;}$
```

a2c2_p3_lpd1

```
UNIT;DEFINE;P3_LPD1;LF;SHIP;COMPANY;52SEQ284030;MANCON_4;;SI
MULATED;FALSE;YES;CIS;LPD_AG_CLASS;$
UNIT;DEFINE;P3_LPD1_AIRSQUAD;LF;AIR_SQUADRON;COMPANY;P3_LPD1
;AIRCON;;SIMULATED;FALSE;YES;USMC;MASS;$
UNIT;DEFINE;P3_LPD1_AIRSUPPLY;LF;SUPPLY;SQUADRON;P3_LPD1;AIR
CON;;SIMULATED;FALSE;NO;$
ASSETS;UPDATE;P3_LPD1_AIRSUPPLY;TROOPS;{0150;HEALTHY;}$
ASSETS;UPDATE;P3_LPD1_AIRSUPPLY;FUEL;1000000;$
ASSETS;UPDATE;P3_LPD1_AIRSUPPLY;RATIONS;5000;$
ASSETS;UPDATE;P3_LPD1_AIRSUPPLY;WATER;50000;$
AIRFIELD;DEFINE;P3_LPD1;P3_LPD1;OPEN;;P3_LPD1_AIRSUPPLY;
{01P3_LPD1_AIRSQUAD;}{00;}$
```

a2c2_p3_inf5_p2_lha1

```
UNIT;DEFINE;P3_INF5;LF;INFANTRY;PLATOON;P2_LHA1;MANCON_4;;SI
MULATED;FALSE;YES;USMC;HMG;$
```

a2c2_p3_inf4_p2_lha1_southbeach

```
AIR_MISSION;DEFINE;LHA_LAND_P3_INF4_SB;MV-
22;1;P2_LHA1_AIRSQUAD;P2_LHA1;;;;STS;
TAKE_OFF;;{01SB;MEDIUM;UNIT_DROP;}$
SERIAL;DEFINE;LHA_LAND_P3_INF4_SB;LF;P2_LHA1;USE_OF_AIRCRAFT
;{01P3_INF4;}SB;MV-22;1;$
SERIAL;ASSOCIATE;LHA_LAND_P3_INF4_SB;LHA_LAND_P3_INF4_SB;$
```

a2c2_p3_inf4_p2_lha1_northbeach

```
AIR_MISSION;DEFINE;LHA_LAND_P3_INF4_NB;MV-
22;1;P2_LHA1_AIRSQUAD;P2_LHA1;;;;STS;
TAKE_OFF;;{01NB;MEDIUM;UNIT_DROP;}$
SERIAL;DEFINE;LHA_LAND_P3_INF4_NB;LF;P2_LHA1;USE_OF_AIRCRAFT
;{01P3_INF4;}NB;MV-22;1;$
SERIAL;ASSOCIATE;LHA_LAND_P3_INF4_NB;LHA_LAND_P3_INF4_NB;$
```

a2c2_p3_inf4_p2_lha1

```
UNIT;DEFINE;P3_INF4;LF;INFANTRY;PLATOON;P2_LHA1;MANCON_4;;SI
MULATED;FALSE;YES;
USMC;IFY_3;$
```

a2c2_p3_inf3_p2_lpd1_southbeach

```
AIR_MISSION;DEFINE;LPD_LAND_P3_INF3_SB;MV-
22;1;P2_LPD1_AIRSQUAD;P2_LPD1;;;;STS;
TAKE_OFF;;{01SB;MEDIUM;UNIT_DROP;}$
SERIAL;DEFINE;LPD_LAND_P3_INF3_SB;LF;P2_LPD1;USE_OF_AIRCRAFT
;{01P3_INF3;}SB;MV-22;1;$
SERIAL;ASSOCIATE;LPD_LAND_P3_INF3_SB;LPD_LAND_P3_INF3_SB;$
```

a2c2_p3_inf3_p2_lpd1_northbeach

```
AIR_MISSION;DEFINE;LPD_LAND_P3_INF3_NB;MV-
22;1;P2_LPD1_AIRSQUAD;P2_LPD1;;;;STS;
TAKE_OFF;;{01NB;MEDIUM;UNIT_DROP;}$
SERIAL;DEFINE;LPD_LAND_P3_INF3_NB;LF;P2_LPD1;USE_OF_AIRCRAFT
;{01P3_INF3;}NB;MV-22;1;$
SERIAL;ASSOCIATE;LPD_LAND_P3_INF3_NB;LPD_LAND_P3_INF3_NB;$
```

a2c2_p3_inf3_p2_lpd1

```
UNIT;DEFINE;P3_INF3;LF;INFANTRY;PLATOON;P2_LPD1;MANCON_4;;SI
MULATED;FALSE;YES;USMC;IFY_3;$
```

a2c2_p3_inf2_p3_lpd1_southbeach

```
AIR_MISSION;DEFINE;LPD_LAND_P3_INF2_SB;MV-
22;1;P3_LPD1_AIRSQUAD;P3_LPD1;;;;STS;
TAKE_OFF;;{01SB;MEDIUM;UNIT_DROP;}$
SERIAL;DEFINE;LPD_LAND_P3_INF2_SB;LF;P3_LPD1;USE_OF_AIRCRAFT
;{01P3_INF2;}SB;MV-22;1;$
SERIAL;ASSOCIATE;LPD_LAND_P3_INF2_SB;LPD_LAND_P3_INF2_SB;$
```

a2c2_p3_inf2_p3_lpd1_northbeach

```
AIR_MISSION;DEFINE;LPD_LAND_P3_INF2_NB;MV-
22;1;P3_LPD1_AIRSQUAD;P3_LPD1;;;;STS;
```

```
TAKE_OFF;;{01NB;MEDIUM;UNIT_DROP;}$
SERIAL;DEFINE;LPD_LAND_P3_INF2_NB;LF;P3_LPD1;USE_OF_AIRCRAFT
;{01P3_INF2;}NB;MV-22;1;$
SERIAL;ASSOCIATE;LPD_LAND_P3_INF2_NB;LPD_LAND_P3_INF2_NB;$
```

a2c2_p3_inf2_p2_lpd1_southbeach

```
AIR_MISSION;DEFINE;LPD_LAND_P3_INF2_SB;MV-
22;1;P2_LPD1_AIRSQUAD;P2_LPD1;;;;STS;
TAKE_OFF;;{01SB;MEDIUM;UNIT_DROP;}$
SERIAL;DEFINE;LPD_LAND_P3_INF2_SB;LF;P2_LPD1;USE_OF_AIRCRAFT
;{01P3_INF2;}SB;MV-22;1;$
SERIAL;ASSOCIATE;LPD_LAND_P3_INF2_SB;LPD_LAND_P3_INF2_SB;$
```

a2c2_p3_inf2_p2_lpd1_northbeach

```
AIR_MISSION;DEFINE;LPD_LAND_P3_INF2_NB;MV-
22;1;P2_LPD1_AIRSQUAD;P2_LPD1;;;;STS;
TAKE_OFF;;{01NB;MEDIUM;UNIT_DROP;}$
SERIAL;DEFINE;LPD_LAND_P3_INF2_NB;LF;P2_LPD1;USE_OF_AIRCRAFT
;{01P3_INF2;}NB;MV-22;1;$
SERIAL;ASSOCIATE;LPD_LAND_P3_INF2_NB;LPD_LAND_P3_INF2_NB;$
```

a2c2_p3_inf2_p2_lpd1

```
UNIT;DEFINE;P3_INF2;LF;INFANTRY;PLATOON;P2_LPD1;MANCON_4;;SI
MULATED;FALSE;YES;USMC;IFY_3;$
```

a2c2_p3_inf1_p3_lpd1_southbeach

```
AIR_MISSION;DEFINE;LPD_LAND_P3_INF1_SB;MV-
22;1;P2_LPD1_AIRSQUAD;P2_LPD1;;;;STS;
TAKE_OFF;;{01SB;MEDIUM;UNIT_DROP;}$
SERIAL;DEFINE;LPD_LAND_P3_INF1_SB;LF;P3_LPD1;USE_OF_AIRCRAFT
;{01P3_INF1;}SB;MV-22;1;$
SERIAL;ASSOCIATE;LPD_LAND_P3_INF1_SB;LPD_LAND_P3_INF1_SB;$
```

a2c2_p3_inf1_p3_lpd1_northbeach

```
AIR_MISSION;DEFINE;LPD_LAND_P3_INF1_NB;MV-
22;1;P3_LPD1_AIRSQUAD;P2_LPD1;;;;STS;
TAKE_OFF;;{01NB;MEDIUM;UNIT_DROP;}$
SERIAL;DEFINE;LPD_LAND_P3_INF1_NB;LF;P3_LPD1;USE_OF_AIRCRAFT
;{01P3_INF1;}NB;MV-22;1;$
SERIAL;ASSOCIATE;LPD_LAND_P3_INF1_NB;LPD_LAND_P3_INF1_NB;$
```

a2c2_p3_inf1_p3_lpd1

```
UNIT;DEFINE;P3_INF1;LF;INFANTRY;PLATOON;P3_LPD1;MANCON_4;;SI
MULATED;FALSE;YES;USMC;IFY_3;$
```

a2c2_p3_inf1_p2_lpd1_southbeach

```
AIR_MISSION;DEFINE;LPD_LAND_P3_INF1_SB;MV-
22;1;P2_LPD1_AIRSQUAD;P2_LPD1;;;;STS;
TAKE_OFF;;{01SB;MEDIUM;UNIT_DROP;}$
```

```
SERIAL;DEFINE;LPD_LAND_P3_INF1_SB;LF;P2_LPD1;USE_OF_AIRCRAFT
;{01P3_INF1;}SB;MV-22;1;$
SERIAL;ASSOCIATE;LPD_LAND_P3_INF1_SB;LPD_LAND_P3_INF1_SB;$
```

a2c2_p3_inf1_p2_lpd1_northbeach

```
AIR_MISSION;DEFINE;LPD_LAND_P3_INF1_NB;MV-
22;1;P2_LPD1_AIRSQUAD;P2_LPD1;;;;STS;
TAKE_OFF;;{01NB;MEDIUM;UNIT_DROP;}$
SERIAL;DEFINE;LPD_LAND_P3_INF1_NB;LF;P2_LPD1;USE_OF_AIRCRAFT
;{01P3_INF1;}NB;MV-22;1;$
SERIAL;ASSOCIATE;LPD_LAND_P3_INF1_NB;LPD_LAND_P3_INF1_NB;$
```

a2c2_p3_inf1_p2_lpd1

```
UNIT;DEFINE;P3_INF1;LF;INFANTRY;PLATOON;P2_LPD1;MANCON_4;;SI
MULATED;FALSE;YES;USMC;IFY_3;$
```

a2c2_p3_eng

```
UNIT;DEFINE;P3_ENG;LF;ENGINEER;COMPANY;52SEQ223087;MANCON_4;
;SIMULATED;FALSE;YES;USMC;CMB_ENG;$
```

a2c2_p3_cas1

```
AIRCRAFT;DEFINE;FA-18;P1_CV1_AIR_SQUAD;0002;QUANTITY;2;$
```

a2c2_p3_aaav3_on_p2_lpd1

```
UNIT;DEFINE;P3_AAAV3;LF;ASSAULT_AMPHIBIAN;PLATOON;P2_LPD1;MA
NCON_4;;SIMULATED;FALSE;YES;USMC;AAV;$
```

a2c2_p3_aaav2_on_p2_lha1

```
UNIT;DEFINE;P3_AAAV2;LF;ASSAULT_AMPHIBIAN;PLATOON;P2_LHA1;MA
NCON_4;;SIMULATED;FALSE;YES;USMC;AAV;$
```

a2c2_p3_aaav1_on_p3_lpd1

```
UNIT;DEFINE;P3_AAAV1;LF;ASSAULT_AMPHIBIAN;PLATOON;P3_LPD1;MA
NCON_4;;SIMULATED;FALSE;YES;USMC;AAV;$
```

a2c2_p3_aaav1_on_p2_lha1

```
UNIT;DEFINE;P3_AAAV1;LF;ASSAULT_AMPHIBIAN;PLATOON;P2_LHA1;MA
NCON_4;;SIMULATED;FALSE;YES;USMC;AAV;$
```

a2c2_p2_vf1

```
AIRCRAFT;DEFINE;F-14;P1_CV1_AIRSQUAD;0001;QUANTITY;2;$
```

a2c2_p2_sof

```
UNIT;DEFINE;P2_SOF;LF;ENGINEER;PLATOON;52SEQ217094;MANCON_3;
;SIMULATED;FALSE;YES;USMC;ENG_BRIDGE;$
```

a2c2_p2_mv22_p2_lha1

```
AIRCRAFT;DEFINE;MV-22;P2_LHA1_AIRSQUAD;2222;QUANTITY;1;$
```

a2c2_p2_med3_lha1

```
AIRCRAFT;DEFINE;UH-
1;P2_LHA1_AIRSQUAD;5555;INDIVIDUAL;{013;}$
```

a2c2_p2_med2_lha1

```
AIRCRAFT;DEFINE;UH-
1;P2_LHA1_AIRSQUAD;5555;INDIVIDUAL;{012;}$
```

a2c2_p2_med1_lpd1

```
AIRCRAFT;DEFINE;UH-
1;P2_LPD1_AIRSQUAD;5555;INDIVIDUAL;{011;}$
```

a2c2_p2_lpd1

```
UNIT;DEFINE;P2_LPD1;LF;SHIP;COMPANY;52SEQ284030;MANCON_3;;SI
MULATED;FALSE;YES;CIS;LPD_AG_CLASS;$
UNIT;DEFINE;P2_LPD1_AIRSQUAD;LF;AIR_SQUADRON;COMPANY;P2_LPD1
;AIRCON;;SIMULATED;FALSE;YES;USMC;MASS;$
UNIT;DEFINE;P2_LPD1_AIRSUPPLY;LF;SUPPLY;SQUADRON;P2_LPD1;AIR
CON;;SIMULATED;FALSE;NO;$
ASSETS;UPDATE;P2_LPD1_AIRSUPPLY;TROOPS;{0150;HEALTHY;}$
ASSETS;UPDATE;P2_LPD1_AIRSUPPLY;FUEL;1000000;$
ASSETS;UPDATE;P2_LPD1;FUEL;1000000;$
ASSETS;UPDATE;P2_LPD1_AIRSUPPLY;RATIONS;5000;$
ASSETS;UPDATE;P2_LPD1_AIRSUPPLY;WATER;50000;$
AIRFIELD;DEFINE;P2_LPD1;P2_LPD1;OPEN;;P2_LPD1_AIRSUPPLY;{01P
2_LPD1_AIRSQUAD;}{00;}$
```

a2c2_p2_lha1

```
UNIT;DEFINE;P2_LHA1;LF;SHIP;COMPANY;52SEQ260000;MANCON_3;;SI
MULATED;FALSE;YES;USN;LHA;$
UNIT;DEFINE;P2_LHA1_AIRSQUAD;LF;AIR_SQUADRON;COMPANY;P2_LHA1
;AIRCON;;SIMULATED;FALSE;YES;USMC;MASS;$
UNIT;DEFINE;P2_LHA1_AIRSUPPLY;LF;SUPPLY;SQUADRON;P2_LHA1;AIR
CON;;SIMULATED;FALSE;NO;$
ASSETS;UPDATE;P2_LHA1_AIRSUPPLY;TROOPS;{0150;HEALTHY;}$
ASSETS;UPDATE;P2_LHA1_AIRSUPPLY;FUEL;1000000;$
ASSETS;UPDATE;P2_LHA1_AIRSUPPLY;RATIONS;5000;$
ASSETS;UPDATE;P2_LHA1_AIRSUPPLY;WATER;50000;$
AIRFIELD;DEFINE;P2_LHA1;P2_LHA1;OPEN;;P2_LHA1_AIRSUPPLY;{01P
2_LHA1_AIRSQUAD;}{00;}$
```

a2c2_p2_inf1_p2_lha1_southbeach

```
AIR_MISSION;DEFINE;LHA_LAND_P2_INF1_SB;MV-
22;1;P2_LHA1_AIRSQUAD;P2_LHA1;;;;STS;
TAKE_OFF;;{01SB;MEDIUM;UNIT_DROP;}$
SERIAL;DEFINE;LHA_LAND_P2_INF1_SB;LF;P2_LHA1;USE_OF_AIRCRAFT
;{01P2_INF1;}SB;MV-22;1;$
SERIAL;ASSOCIATE;LHA_LAND_P2_INF1_SB;LHA_LAND_P2_INF1_SB;$
```

a2c2_p2_inf1_p2_lha1_northbeach

```
AIR_MISSION;DEFINE;LHA_LAND_P2_INF1_NB;MV-
22;1;P2_LHA1_AIRSQUAD;P2_LHA1;;;;STS;
```

```
TAKE_OFF;;{01NB;MEDIUM;UNIT_DROP;}$
SERIAL;DEFINE;LHA_LAND_P2_INF1_NB;LF;P2_LHA1;USE_OF_AIRCRAFT
;{01P2_INF1;}NB;MV-22;1;$
SERIAL;ASSOCIATE;LHA_LAND_P2_INF1_NB;LHA_LAND_P2_INF1_NB;$
```

a2c2_p2_inf1_p2_lha1

```
UNIT;DEFINE;P2_INF1;LF;INFANTRY;PLATOON;P2_LHA1;MANCON_3;;SI
MULATED;FALSE;YES;USMC;IFY_3;$
```

a2c2_p2_eng

```
UNIT;DEFINE;P2_ENG;LF;ENGINEER;COMPANY;52SEQ211081;MANCON_3;
;SIMULATED;FALSE;YES;USMC;CMB_ENG;$
```

a2c2_p2_ddg2

```
UNIT;DEFINE;P2_DDG2;LF;SHIP;COMPANY;52SEQ455151;MANCON_3;;SI
MULATED;FALSE;YES;USN;BURKE_CLASS;$
```

a2c2_p2_ddg1

```
UNIT;DEFINE;P2_DDG1;LF;SHIP;COMPANY;52SEQ489065;MANCON_3;;SI
MULATED;FALSE;YES;USN;BURKE_CLASS;$
```

a2c2_p2_cas1

```
AIRCRAFT;DEFINE;FA-18;P1_CV1_AIR_SQUAD;0002;QUANTITY;2;$
```

a2c2_p2_aaav1_on_p2_lha1

```
UNIT;DEFINE;P2_AAAV1;LF;ASSAULT_AMPHIBIAN;PLATOON;P2_LHA1;MA
NCON_3;;SIMULATED;FALSE;YES;USMC;AAV;$
```

a2c2_p1_vf4

```
AIRCRAFT;DEFINE;F-14;P1_CV1_AIR_SQUAD;0001;QUANTITY;2;$
```

a2c2_p1_vf3

```
AIRCRAFT;DEFINE;F-14;P1_CV1_AIR_SQUAD;0001;QUANTITY;2;$
```

a2c2_p1_vf2

```
AIRCRAFT;DEFINE;F-14;P1_CV1_AIR_SQUAD;0001;QUANTITY;2;$
```

a2c2_p1_vf1

```
AIRCRAFT;DEFINE;F-14;P1_CV1_AIR_SQUAD;0001;QUANTITY;2;$
```

a2c2_p1_ffg2

```
UNIT;DEFINE;P1_FFG2;LF;SHIP;COMPANY;52SEP338949;MANCON_2;;SI
MULATED;FALSE;YES;USN;PERRY_CLASS;$
```

a2c2_p1_ffg1

```
UNIT;DEFINE;P1_FFG1;LF;SHIP;COMPANY;52SEQ421115;MANCON_2;;SI
MULATED;FALSE;YES;USN;PERRY_CLASS;$
```

a2c2_p1_ddg1

```
UNIT;DEFINE;P1_DDG1;LF;SHIP;COMPANY;52SEP377967;MANCON_2;;SI
MULATED;FALSE;YES;USN;BURKE_CLASS;$
```

a2c2_p1_cv1

```
UNIT;DEFINE;P1_CV1;LF;SHIP;COMPANY;52SEQ354037;MANCON_2;;SIM
ULATED;FALSE;YES;USN;JFK_CLASS;$
UNIT;DEFINE;P1_CV1_AIRSUPPLY;LF;SUPPLY;COMPANY;P1_CV1;AIRCON
;;SIMULATED;FALSE;YES;USMC;MAT_SUP;$
UNIT;DEFINE;P1_CV1_AIRSQUAD;LF;AIR_SQUADRON;SQUADRON;P1_CV1;
AIRCON;;SIMULATED;FALSE;YES;USMC;VMAAW;$
AIRFIELD;DEFINE;P1_CV1;P1_CV1;OPEN;P1_CV1_AIRSUPPLY;P1_CV1_A
IRSUPPLY;{01P1_CV1_AIRSQUAD;}{00;}$
ASSETS;UPDATE;P1_CV1_AIRSQUAD;ASSET;{04MK-84-
BOMB;500;OPERATIONAL;ZUNI-RKT-4;
500;OPERATIONAL;20MM-HE-AC;100000;OPERATIONAL;MAVERICK-TV-
MSL;500;OPERATIONAL;}$
ORD_LOAD;DEFINE;VF_AIR_ORD;LF;{04MK-84-BOMB;8;Q;MAVERICK-TV-
MSL;8;Q;ZUNI-RKT-4;8;Q;20MM-HE-AC;1000;NONE;}$
```

a2c2_p1_cg1

```
UNIT;DEFINE;P1_CG1;LF;SHIP;COMPANY;52SEQ340014;MANCON_2;;SIM
ULATED;FALSE;YES;USN;BELKNAP_CLASS;$
```

a2c2_p1_cas1

```
AIRCRAFT;DEFINE;FA-18;P1_CV1_AIRSQUAD;0002;QUANTITY;2;$
```

a2c2_p0_vf4

```
AIRCRAFT;DEFINE;F-14;P1_CV1_AIRSQUAD;0001;QUANTITY;2;$
```

a2c2_p0_vf3

```
AIRCRAFT;DEFINE;F-14;P1_CV1_AIRSQUAD;0001;QUANTITY;2;$
```

a2c2_p0_vf2

```
AIRCRAFT;DEFINE;F-14;P1_CV1_AIRSQUAD;0001;QUANTITY;2;$
```

a2c2_p0_vf1

```
AIRCRAFT;DEFINE;F-14;P1_CV1_AIRSQUAD;0001;QUANTITY;2;$
```

a2c2_p0_tarps

```
AIRCRAFT;DEFINE;F-14;P1_CV1_AIRSQUAD;3333;QUANTITY;2;$
```

a2c2_p0_launch_tarps

```
AIR_MISSION;DEFINE;TARPS;F-
14;2;P1_CV1_AIRSQUAD;P1_CV1;;;;RECON;{04PHOTO;IR;
SLAR;VISUAL;}TAKE_OFF;;{0152SEQ353053;MEDIUM;ORBIT;}$
```

a2c2_p0_cas2

```
AIRCRAFT;DEFINE;FA-18;P1_CV1_AIR_SQUAD;0002;QUANTITY;2;$
```

a2c2_p0_cas1

```
AIRCRAFT;DEFINE;FA-18;P1_CV1_AIR_SQUAD;0002;QUANTITY;2;$
```

a2c2_launch_p5_cas1

```
AIR_MISSION;DEFINE;P5_CAS1;FA-
18;2;P1_CV1_AIRSQUAD;P1_CV1;;;P5_ENG;CAS;CAS_ORD;
;;FALSE;TAKE_OFF;;{0152SEQ306046;MEDIUM;ORBIT;}$
```

a2c2_launch_p4_cas2

```
AIR_MISSION;DEFINE;P4_CAS2;FA-
18;2;P1_CV1_AIRSQUAD;P1_CV1;;;P5_ENG;CAS;CAS_ORD;
;;FALSE;TAKE_OFF;;{0152SEP357997;MEDIUM;ORBIT;}$
```

a2c2_launch_p4_cas1

```
AIR_MISSION;DEFINE;P4_CAS1;FA-
18;2;P1_CV1_AIRSQUAD;P1_CV1;;;P5_ENG;CAS;CAS_ORD;
;;FALSE;TAKE_OFF;;{0152SEQ321022;MEDIUM;ORBIT;}$
```

a2c2_launch_p3_cas1

```
AIR_MISSION;DEFINE;P3_CAS1;FA-
18;2;P1_CV1_AIRSQUAD;P1_CV1;;;P5_ENG;CAS;CAS_ORD;
;;FALSE;TAKE_OFF;;{0152SEQ371072;MEDIUM;ORBIT;}$
```

a2c2_launch_p1_cas1

```
AIR_MISSION;DEFINE;P1_CAS1;FA-
18;2;P1_CV1_AIRSQUAD;P1_CV1;;;P5_ENG;CAS;CAS_ORD;
;;FALSE;TAKE_OFF;;{0152SEQ334058;MEDIUM;ORBIT;}$
```

a2c2_create_terrain

```
CE;CONSTRUCT;RD1;;;IMPROVED_SURFACE;ROAD;ASPHLT-2-
LANE;{1352SEQ325127;
52SEQ324121;52SEQ317117;52SEQ309120;52SEQ305117;52SEQ303114;
52SEQ292105;52SEQ269104;52SEQ263102;52SEQ255087;52SEQ222069;
52SEQ219066;52SEQ210026;}$
CE;CONSTRUCT;RD2;;;IMPROVED_SURFACE;ROAD;ASPHLT-2-LANE;
{1752SEQ237077;52SEQ238073;52SEQ234063;52SEQ237052;52SEQ2340
44;
52SEQ236039;52SEQ232026;52SEQ224024;52SEQ219018;52SEQ214017;
52SEQ213014;52SEQ202001;52SEP194994;52SEP190994;52SEQ183004;
52SEQ167000;52SEP154985;}$
CE;CONSTRUCT;RD3;;;IMPROVED_SURFACE;ROAD;ASPHLT-2-
LANE;{1552SEQ235161;52SEQ234158;52SEQ235156;52SEQ233155;
52SEQ235150;52SEQ234147;52SEQ240140;52SEQ239126;52SEQ235119;
52SEQ235109;52SEQ230101;52SEQ228100;52SEQ227090;52SEQ222080;
52SEQ221079;}$
CE;CONSTRUCT;RD4;;;IMPROVED_SURFACE;ROAD;ASPHLT-2-LANE;
{0852SEQ128118;52SEQ133118;52SEQ145110;52SEQ145107;52SEQ1490
92;
52SEQ172079;52SEQ188084;52SEQ202076;}$
CE;CONSTRUCT;RD5;;;IMPROVED_SURFACE;ROAD;ASPHLT-2-LANE;
{0352SEQ221077;52SEQ219066;52SEQ204076;}$
```

```
CE;CREATE;HILL;NATURAL_TERRAIN;MOUNTAIN;MOUNTAIN;{0652SEQ284
126;52SEQ276122;52SEQ275115;52SEQ284111;52SEQ294116;52SEQ292
125;}$
CE;CREATE;PORT;STRUCTURE;PORT-
FACILITY;52SEQ315116;15;40;100;$
CE;CREATE;RVR1;NATURAL_TERRAIN;RIVER;RIVER;100;{0352SEQ24209
0;52SEQ223076;52SEQ213087;}$
CE;CREATE;RVR2;NATURAL_TERRAIN;RIVER;RIVER;100;{0252SEQ21308
7;52SEQ196068;}$
CE;CONSTRUCT;BRIDGE1;;;IMPROVED_SURFACE;BRIDGE;CONCRETE-
BRIDGE-A;52SEQ203076;RVR1;$
CE;CONSTRUCT;BRIDGE2;;;IMPROVED_SURFACE;BRIDGE;CONCRETE-
BRIDGE-A;52SEQ221078;RVR2;$
```

a2c2_create_intel_blue

```
UNIT;DEFINE;INTEL;LF;RECONNAISSANCE;PLATOON;52SEQ205092;INT_
CON_1;;SIMULATED;TRUE;YES;USMC;DIV_RECON;$
ASSETS;UPDATE;INTEL;ASSET;{01SENSOR-1;16;OPERATIONAL;}$
```

a2c2_cas_ord

```
ORD_LOAD;DEFINE;CAS_ORD;LF;{02MK-84-LGB;32;Q;MAVERICK-TV-
MSL;32;Q;}$
ASSETS;UPDATE;P1_CV1_AIRSQUAD;ASSET;{03MAVERICK-TV-
MSL;1000;OPERATIONAL;
NAPALM-BOMB;1000;OPERATIONAL;MK-84-LGB;1000;OPERATIONAL;}$
```

a2c2_beaches_and_LZs

```
BEACH;DEFINE;SOUTH_BCH;LF;52SEQ230006;52SEQ245020;;;52SEQ232
004;52SEQ249016;52SEQ237015;{0352SEQ252014;52SEQ236002;52SEQ
252004;};;;$
BEACH;DEFINE;NORTH_BCH;LF;52SEQ268065;52SEQ289074;;;52SEQ269
061;52SEQ292071;52SEQ279073;{0352SEQ275060;52SEQ293066;52SEQ
289054;};;;$
CHECKPOINT;DEFINE;NB;52SEQ276071;LF;YES;$
CHECKPOINT;DEFINE;SB;52SEQ235012;LF;YES;$
```

a2c2_airfield

```
UNIT;DEFINE;P2_LHA1_AIRSUPPLY;LF;SUPPLY;SQUADRON;P2_LHA1;AIR
CON;;SIMULATED;FALSE;NO;$
ASSETS;UPDATE;P2_LHA1_AIRSUPPLY;TROOPS;{0150;HEALTHY;}$
ASSETS;UPDATE;P2_LHA1_AIRSUPPLY;FUEL;1000000;$
ASSETS;UPDATE;P2_LHA1_AIRSUPPLY;RATIONS;5000;$
ASSETS;UPDATE;P2_LHA1_AIRSUPPLY;WATER;50000;$
AIRFIELD;DEFINE;P2_LHA1;P2_LHA1;OPEN;;P2_LHA1_AIRSUPPLY;{01P
2_LHA1_AIRSQUAD;}{00;}$
```

Master Batch Files

A2C2_A0

```
a2c2_create_terrain
a2c2_beaches_and_LZs
```

```
a2c2_red_defense
a2c2_trucks_create
a2c2_run_trucks
a2c2_p1_cg1
a2c2_p1_cv1
a2c2_p1_ddg1
a2c2_p1_ffg1
a2c2_p1_ffg2
a2c2_p2_lha1
a2c2_p2_lpd1
a2c2_p2_mv22_p2_lha1
a2c2_p3_mv22a_p2_lpd1
a2c2_p3_mv22b_p2_lpd1
a2c2_p3_aaav1_on_p2_lha1
a2c2_p3_aaav2_on_p2_lha1
a2c2_p3_aaav3_on_p2_lpd1
a2c2_p0_tarps
a2c2_p0_vf1
a2c2_p0_vf2
a2c2_p0_vf3
a2c2_p0_vf4
a2c2_p1_cas1
a2c2_p2_inf1_p2_lha1
a2c2_p2_med1_lpd1
a2c2_p2_med2_lha1
a2c2_p2_med3_lha1
a2c2_p3_inf1_p2_lpd1
a2c2_p3_inf2_p2_lpd1
a2c2_p3_inf3_p2_lpd1
a2c2_p3_inf4_p2_lha1
a2c2_p3_eng
a2c2_p4_cas1
a2c2_p4_cas2
a2c2_p5_cas1
a2c2_p5_eng
a2c2_p5_sof
a2c2_p4_ah1-1_p2_lpd1
a2c2_cas_ord
```

APPENDIX B. UNIT LISTINGS

DM	Asset	A0	A0post	A1	A2	A0'	A0'post
Player 0	SAT	1	1	1	1	1	1
	VF	4	3	0	0	0	0
	SMC	0	0	1	0	0	0
	CAS	0	0	1	2	0	0
	TARPS	1	0	0	0	1	0
Player 1	CG	1	1	1	1	1	1
	FFG	2	1	1	1	2	1
	CAS	1	1	0	0	1	1
	DDG	0	0	1	1	0	0
	VF	0	0	1	0	4	3
	CV	0	0	1	1	1	1
	SMC	0	0	0	1	0	0
Player 2	MV22	1	1	0	0	1	1
	SMC	2	1	0	0	2	1
	DDG	2	1	0	0	2	1
	INF	1	1	0	1	1	1
	MED	3	3	0	0	3	3
	LHA	1	1	0	1	1	1
	LPD	1	1	0	1	1	1
	VF	0	0	0	1	0	0
	CAS	0	0	0	1	0	0
	ENG	0	0	0	1	0	0
	SOF	0	0	0	1	0	0
	AAAV	0	0	0	1	0	0
	SD	0	0	0	1	0	0
Player 3	MV22	2	1	2	1	2	1
	INF	4	3	2	1	5	1
	AAAV	3	2	1	0	3	3
	SD	1	1	1	0	2	1
	ENG	1	0	1	0	0	0
	CAS	0	0	1	0	0	0
	SOF	0	0	1	0	0	0
	LPD	0	0	1	0	0	0
	VF	0	0	1	0	0	0
	MED	0	0	1	2	0	0
Player 4	AH-1W	4	0	0	0	4	0
	CAS	2	2	1	0	2	2
	INF	0	0	2	2	0	0
	MV22	0	0	1	1	0	0
	MED	0	0	2	1	0	0
	LHA	0	0	1	0	0	0
	VF	0	0	1	1	0	0
	AAAV	0	0	1	1	0	0
Player 5	SOF	1	1	0	0	1	1
	CAS	1	0	0	0	1	0
	ENG	1	1	0	0	1	1

APPENDIX C. ARCHITECTURES

The following pages contain pictures of the organization structure of the various architectures used in A2C2 experiment number 3. [Ref 1].

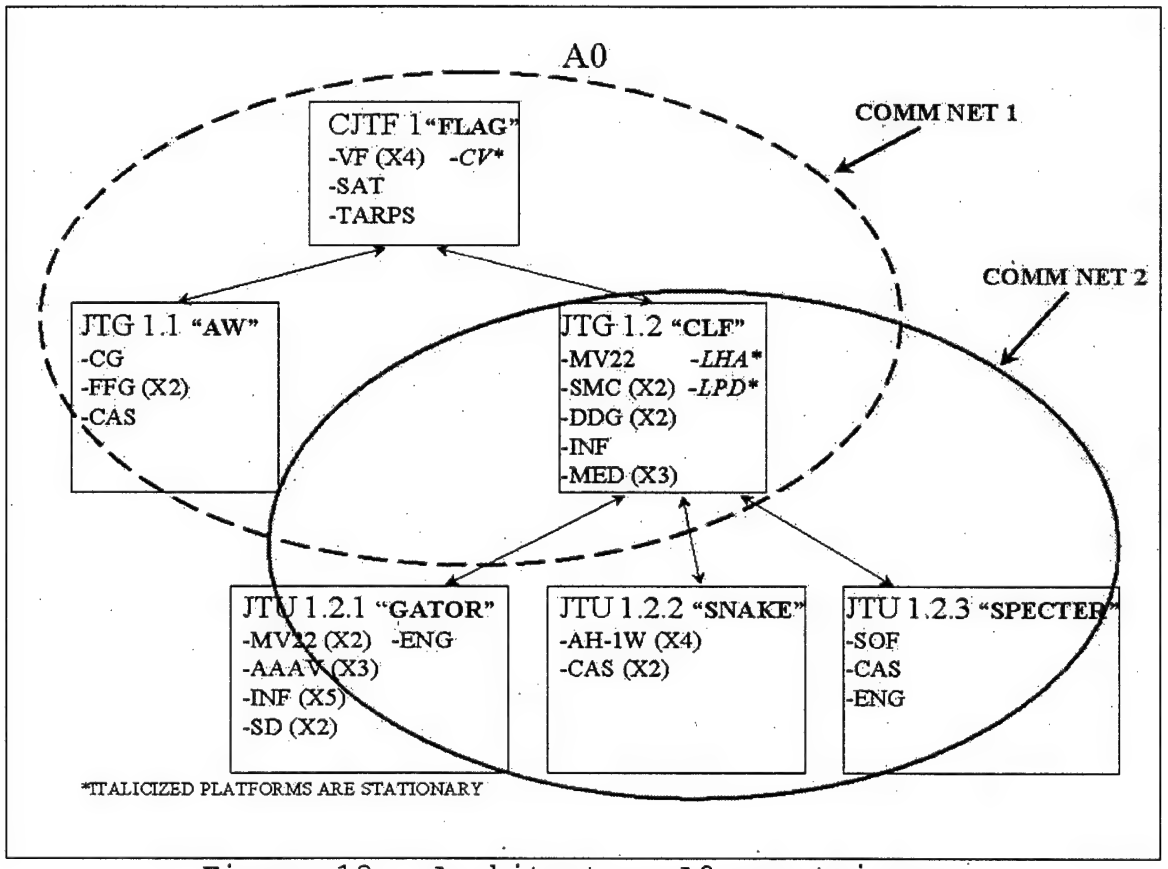


Figure 18. Architecture A0 pre trigger.

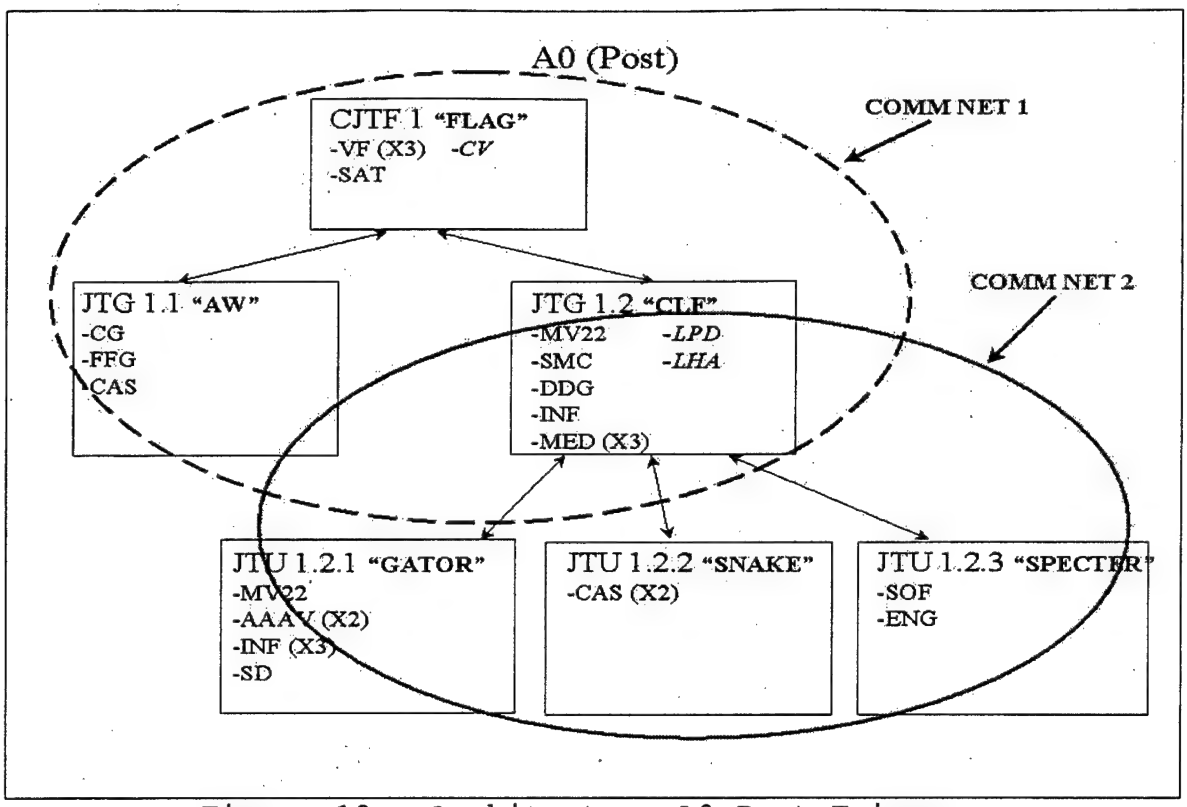


Figure 19. Architecture A0 Post-Trigger.

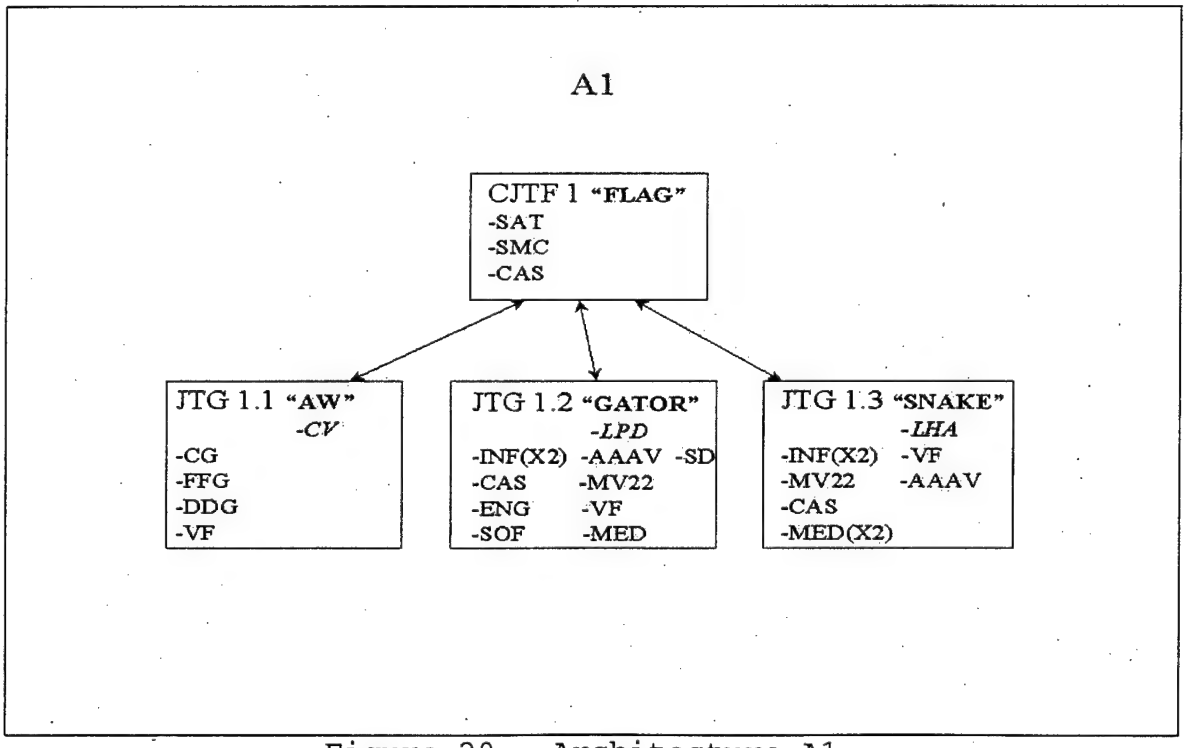


Figure 20. Architecture A1.

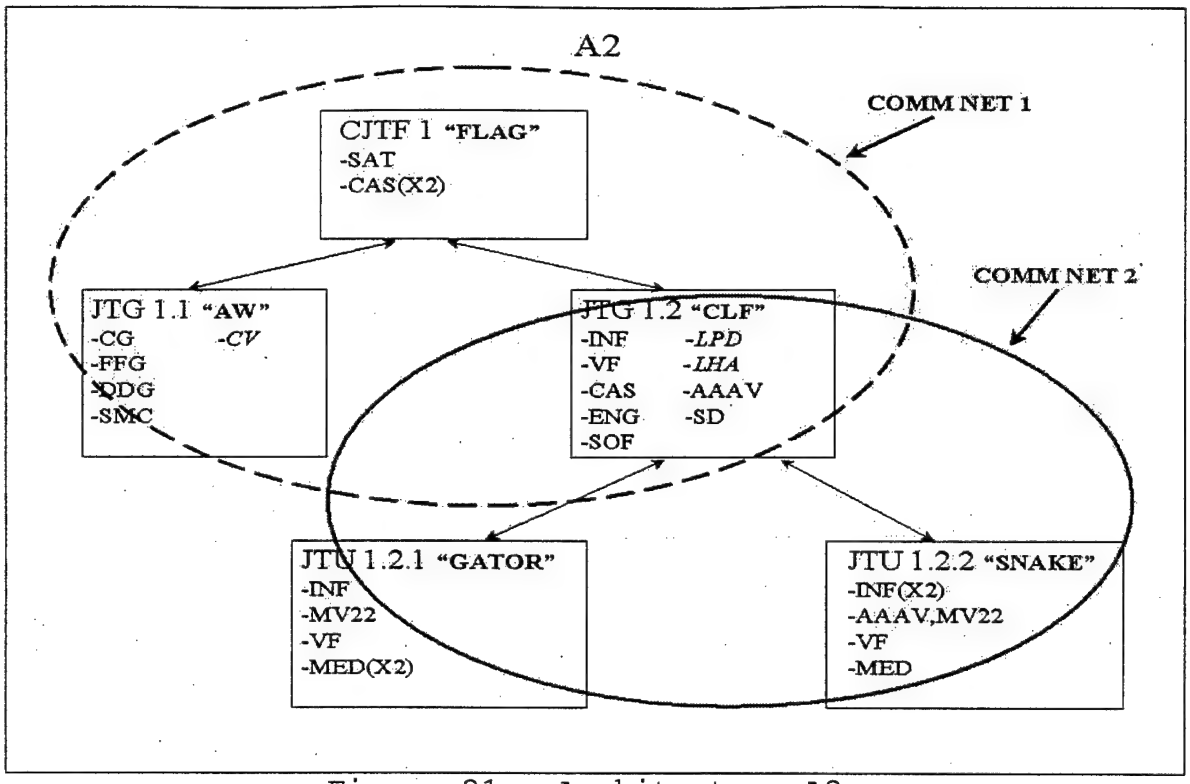


Figure 21. Architecture A2.

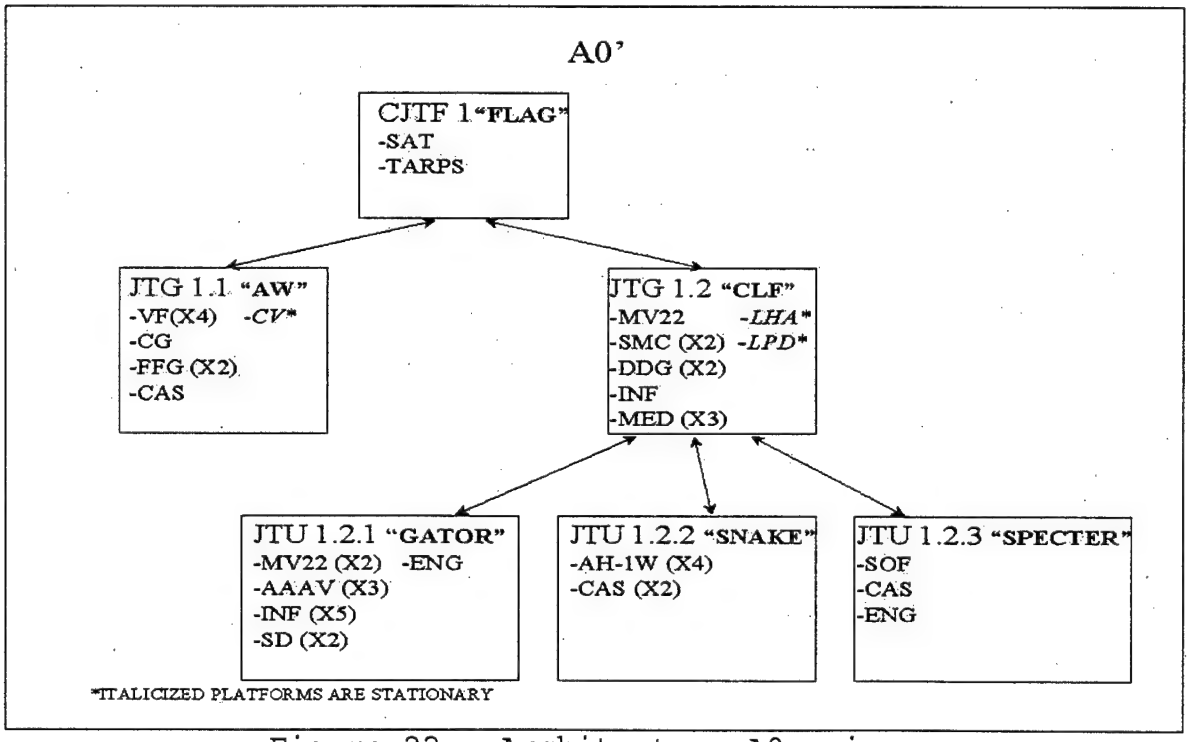


Figure 22. Architecture A0 prime.

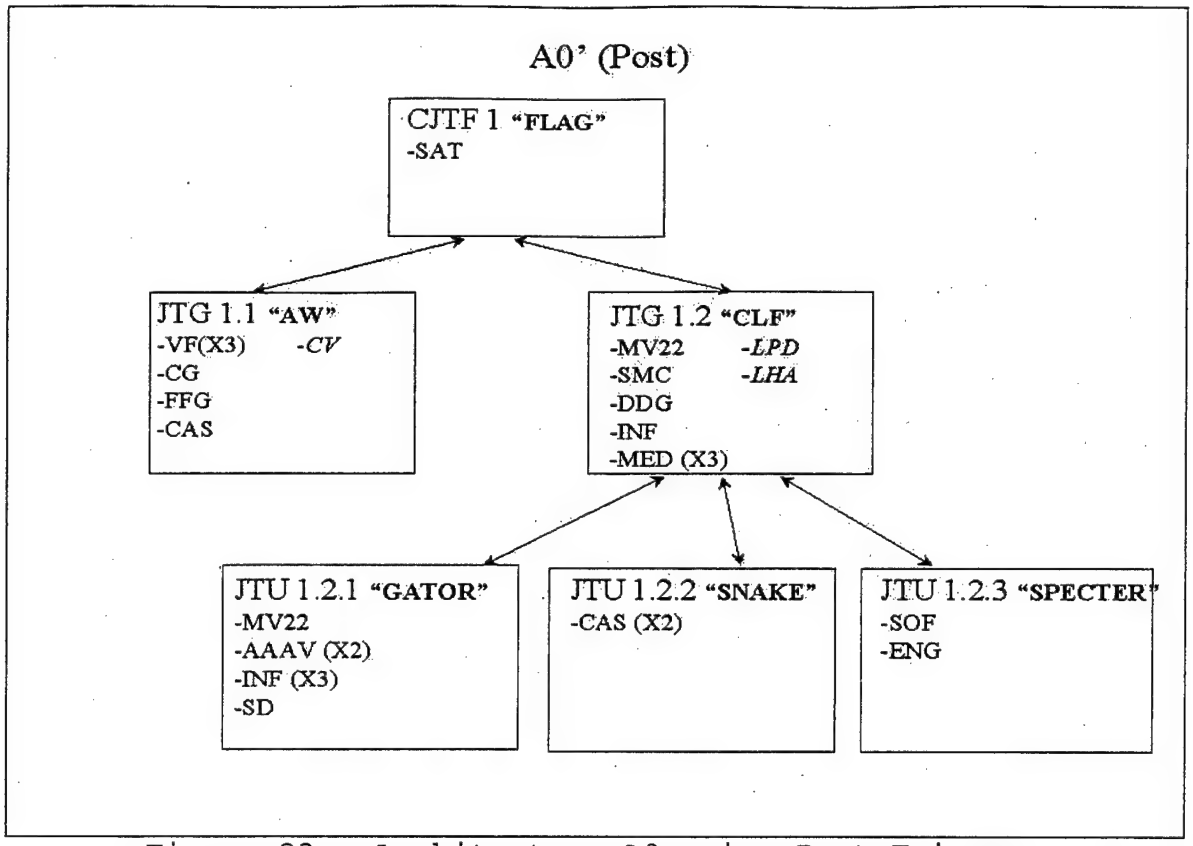


Figure 23. Architecture A0 prime Post-Trigger.

APPENDIX D. THE A2C2 SCENARIO

The document on the following pages is the fictitious operational order that was used for A2C2 experiment number three. [Ref. 1].

IMMEDIATE

FROM: USCINCMED NAPLES IT
JTF 1000

TO: CJCS WASHINGTON DC
USCINCCENT MACDILL AFB FL
USCINCLANT NORFOLK VA
USCINCEUR VAIHINGEN GE
CINCFOR FT MCPHERSON GA
USCINCPAC HONOLULU HI
USCINCTRANS SCOTT AFB IL
USCINCSTRAT OFFUTT AFB NE
COMMARFORPAC HONOLULU HI
CINCPACFLT HONOLULU HI

INFO: WHITEHOUSE SITUATION ROOM WASHINGTON DC
SECSTATE WASHINGTON DC
SECDEF WASHINGTON DC
CSA WASHINGTON DC
CMC WASHINGTON DC
CNO WASHINGTON DC

DISTR: CINC/DCINC/CCJ1/CCJ2/CCJ3/CCJ4/CCJ5/CCJ6

FOR OFFICIAL USE ONLY
OPER/REDNOSE//
MSGID/ORDER/USCINCCENT//
AMPN/SPECIAL HANDLING INSTRUCTIONS
REF/A/ORDER/CJCS/011742Z NOV 97//
REF/B/ORDER/CJCS/041142Z NOV 97//
NARR/JT STRAT CAP PLN (FY 97), CJCS ALERT ORDER//
ORDTYP/OPORD/USCINCCENT 12-97//
MAP/1015/TUNSIA//
MAP/1020/ALGERIA//
NARR/SCALE 1:100,000//
TIMEZONE/Z//

HEADING/TASK ORGANIZATION//

5UNIT

/UNITDES	/UNITLOC	/CMNTS
/USCINCLANT	/NORFOLK VA	
/USCINCEUR	/VAIHINGEN GE	
/CINCFOR	/FT MCPHERSON GA	
/USCINCPAC	/HONOLULU HI	
/USCINCTRANS	/SCOTT AFB IL	/2 TAC ARLFT SQ /6KC-10
/USCINCSTRAT	/OFFUTT AFB NE	/2 RC-135
/COMMARFORPAC	/HONOLULU HI	/1 MEB
/CINCPACFLT	/HONOLULU HI	
/HQ USMEDCOM FWD		/(JTF 1000)
/HQ USMEDAF (MINUS)		
/2 E-3A (AWACS)		
/HQ USNAVMED (MINUS)		
/SUPPORTING FORCES		
/COMSUPNAVFOR		
/CTG 60.1 (CVBG)		
/ARG 55.2		
/ 1 MEB		
/MPS//		

GENTEXT/SITUATION

1. (FOUO) Country Orange has attacked the friendly nation of Country Green, an U.S. ally. Attacking forces have succeeded in seizing Country Green port of Eastport. Country Green government has requested U.S. assistance in taking back port of Eastport and driving Country Orange forces from Country Green.

A. (FOUO) ENEMY FORCES

(1) (FOUO) See current SITREP and DIN. The port of Eastport is protected by obstructions, mines, obstacles, and the presence of hidden enemy among the port facility buildings. Two beaches approx. 5 miles south of the port may be suitable for amphibious assault. Northernmost beach (designated "North Beach") has road leading to the port. Southernmost beach (designated "South Beach") has a road leading to the airfield. Waterborne approaches to the beaches are possibly mined. Commanding terrain to north of Red Beach believed occupied by enemy Heavy Mortar Platoon with a platoon of Infantry for security. This terrain dominates both North Beach and the port. Seizure and retention of this dominant terrain should be considered essential for successful attack on Red Beach and port.

(2) (FOUO) There are two Orange bases inland. Intel reports indicate that mobile missile forces occupy one of the bases, but it is not known which. Each base is connected by road to the port-Red Beach road and the road to each base has a bridge. Missile units from either bas will have to travel down the road and cross the bridge to bring U.S. forces to within effective range. Orange tactics and the current situation dictate that Orange send an advanced force to secure the bridge before sending

any Transporter Erector Launchers (TELs) across. To prevent this, a Special Operations Force (SOF) has been inserted at an observation post (OP) near the bridges. Their mission is to determine which base the missile force occupies and blow up the bridge leading to that base. There is a significant amount of neutral commercial traffic on the connecting roads, and while the SOF sensors can detect traffic on the far side of the bridges, they cannot discriminate between neutral commercial traffic and a hostile advance force. Air (TARPS) or space based (SAT) sensors will have to be used to establish positive hostile identification (PHID).

(3) (FOUO) Believed to be at the port, but hidden from view, is company-sized armored counterattack force that could move toward North Beach in response to any amphibious assault. Similar counterattack force may exist at airfield, which is located about 5 miles inland from the South Beach. These counterattack forces could inflict serious damage if not interdicted before they reach either beach. Off-road terrain between beach, port, airfield, and commanding terrain is swampy and treacherous; and is unsuitable for travel. Thus, all ground travel, with the exception of the SOF who are equipped with advanced All-Terrain Vehicles (ATVs), must be on the roads. It is believed that one or both of the roads, which connect the port and airfield to the beaches, will be mined. Locations of any minefields are currently unknown. Port, airfield, both roads, both beaches, and commanding terrain are located within range of artillery strong points, which must be suppressed. Northernmost strong-point can fire on North Beach and port. Southernmost strongpoint can fire on both South Beach and airfield. Artillery pieces at both strong points are housed in reinforced concrete bunkers, with ammunition stored in deep underground bunkers. It is unlikely that even concentrated air attacks will completely disable the artillery strong points. Enemy can be expected to wheel out artillery pieces (from 8 to 24 at a time), set up, sight in, and fire in under 2.5 minutes. If friendly forces can get effective NSFS on target in less than 2.5 minutes, the enemy will probably wheel their artillery pieces back into bunkers and wait until another time.

(4) (FOUO) Enemy Surface-to-Air Missile (SAM) sites and decoys have been erected around the port and airfield. The SAM sites must be identified and destroyed before air support or helo-borne forces can safely be used for the attack on the port. To minimize collateral damage, the sites must be hit with guided munitions.

(5) (FOUO) Enemy also has several Frog Missile Launchers (SCUD-like) capable of carrying chemical munitions. Frogs are believed to be hidden in the vicinity of both artillery strongpoints. They can emerge from covered positions, prepare warheads, and fire missiles within 4 minutes. Past experience has shown that Frog crews are more stalwart than artillery crews. They will continue to prepare and launch their missiles even if they are being suppressed by NSFS or artillery.

(6) (FOUO) Submarine threat to U.S. Naval forces is considerable. Enemy Alfa-Class submarines are known to be in the area. To protect the fleet, these submarines must be detected and destroyed.

(7) (FOUO) Enemy possesses HIND Helicopters, and has demonstrated the capability to launch anti-ship missiles from its helicopters. The only significant capability the ARG or CVBG possesses against these helicopters is one Stinger Platoon.

(8) (FOUO) The enemy has significant air strike capability, and can launch anti-ship missiles from most of its strike aircraft.

(9) (FOUO) The enemy's Maritime Special Forces also possess numerous fast patrol boats (PBs), that can either fire very potent torpedoes, be loaded with explosives for suicide missions, or carry troops and supplies to reinforce Orange forces. These can be engaged and destroyed by the CG, DDGs, FFGs, fighters, and Cobras. But, they have been camouflaged to resemble a type of commercial coastal craft common in the area, and they are known to travel at the same speed as coastal traffic to avoid giving away their identity. These PBs must be identified by either SAT, TARPS, or very close inspection by friendly surface platforms before they can be engaged. There are two popular coastal trade routes between the mainland and a large island to the east. One route goes to the north of Green and passes close to a small inlet which could support offloading of troops and supplies to Orange forces occupying the port area. The other route passes south along the east coast and passes close to a beach south of the airfield, which could support offloading of troops and supplies to reinforce Orange forces around the airfield. Maritime traffic along these routes, and in the region overall, must be positively identified to ensure the destruction of all hostile boats while avoiding attacking neutral shipping.

(10) (FOUO) There is also a Silkworm threat along the coastline. These Silkworm missiles were placed in residential neighborhoods by the enemy because they knew U.S. planners would be reluctant to target residential areas. Accordingly, if U.S. forces want to target a Silkworm launcher, they must first get positive confirmation of its presence, using reconnaissance assets (TARPS, SOF, Satellite). Any strike must use precision guided munitions (CAS).

B. (FOUO) FRIENDLY FORCES. JTF will be comprised primarily of assets organic to Mediterranean Command (MEDCOM). A theater-level JFACC and other friendly forces are operating against the enemy in Country Green, but not in concert with the JTF. This forces the requirement to identify contacts prior to attacking to ensure friendly and neutral forces are not destroyed.

(1) (FOUO) JTF will consist of one Aircraft Carrier Battle Group (CVBG), and a Amphibious Ready Group (ARG) with embarked Marines. The ARG will be composed of 1 LHA and 1 LPD. CVBG will be composed of 1 CV, 1 AEGIS cruiser, 2 DDGs, and 2 FFGs.

(2) (FOUO) The CVBG and ARG aircraft available to support the JTF are 4 sections of F-14s, 4 sections of F/A-18s, and 1 TARPS equipped F-14. The F/A-18s from the CV are equipped with Laser Guided Bombs (LGBs) and can attack Frog missile sites or confirmed Silkworm sites, or they can be used to provide Close Air Support (CAS) for friendly ground units. The F-14s can be used for Anti-Air Warfare (AAW) and for Combat Air Patrol (CAP). The F-14 TARPS can be used for reconnaissance missions only.

(3) (FOUO) In addition to TARPS, the JTF has access to an imagery satellite (SAT platform) which can provide continuous wide-angle "detection" coverage throughout the objective area. High-resolution "identification" coverage is available for a small (movable) area.

(3) (FOUO) Two DDGs will be in position to provide NSFS. Small Minesweeping Craft (SMCs) are attached to the ARG to clear sea mines if detected.

(4) (FOUO) The Marine amphibious forces are embarked on the ARG. The ARG is composed of three Advanced Amphibious Assault Vehicle (AAAV)-mounted rifle companies, three V-22 Osprey-mounted heliborne rifle companies, 4 sections of AH-1W SeaCobras (indivisible), two mineclearing boats (SMCs), two engineer platoons, and three of MEDEVAC helicopters. Engineers must be used to breach any minefields encountered by JTF ground forces. Cobras are the only JTF assets which

by themselves are effective against armored formations. Two Stinger Detatchments will provide a close-in anti-air capability.

(5) (FOUO) Ground forces have unmanned aerial vehicles (UAVs) flying in support for the duration of the operation. Continuous live feed will be fed to the Common Operational Picture (COP) available to all friendly forces.

GENTEXT/MISSION

2. (FOUO) On order, JTF 1 ground forces will seize and defend Country Green Port of Eastport, to allow introduction of follow on forces in support of Country Green government troops. Sea-based forces will support amphibious assault with CAS, naval gunfire, and air defense assets to defend the CVBG and ARG from air, surface, and subsurface threats.//

GENTEXT/EXECUTION/

3. (FOUO) CONCEPT OF OPERATIONS

A. GROUND. The SOF will be inserted prior to the commencement of the amphibious landings. One AAAV-mounted rifle company will land on each beach near-simultaneously. As a prerequisite to this, one heliborne rifle company will secure the commanding terrain overlooking Red Beach and the port in a coordinated attack. Once BOTH beaches and commanding terrain are secure, the two AAAV-mounted companies will proceed on foot down the roads from their respective beaches, clearing minefields with engineer platoons, killing counterattack forces with Cobras, and conducting MEDEVACS as necessary. The roads must be cleared prior to attacking the port or airfield. The SOF should conduct surveillance to locate the enemy missile force and destroy the applicable bridge, then proceed as directed to assist in assaults on the port and airfield. The UAVs will keep the artillery strong points and the suspected FROG sites under constant surveillance, so that NSFS or CAS assets can be brought to bear immediately if they are needed. Once the roads have been cleared, the AAAV-mounted companies will take the port and airfield. A heliborne company will assist the company attacking the airfield. It is important that once the AAAV-mounted companies land on the beach, the airfield and port be taken as quickly as possible, before the enemy has a chance to organize his defense and send reinforcements. It is desired that final assaults on the airfield and port occur simultaneously, in order to present the enemy commander with the most confusing environment possible. However, if one attack must occur before the other, the airfield has the priority. If the airfield attack is held up for any reason, the port attack should wait to retain the synergism of concurrent attacks. If the port attack is held up, the airfield attack should go forward.

B. MARITIME. Due to hydrographic limitations, the ARG and the CVBG will have to be significantly separated during the operation, enough to preclude them from being under a Joint Air Defense umbrella provided by the AEGIS Cruiser. Thus, the AEGIS Cruiser will remain with the CVBG, but will position itself so that it can rapidly move from the CVBG to the ARG if that becomes necessary. Additionally, the two DDGs are inshore, providing NSFS support, while the FFGs are primary ASW platforms for the CVBG. The FFGs performing ASW will, like the AEGIS Cruiser, position themselves so that they can quickly move to support the ARGs if that is necessary. The frigates, AEGIS cruiser, and destroyers can attack or be attacked by the enemy patrol boats. The ARGs will launch the Marines for the initial assault on Ted and Blue Beaches at the commencement of the operation, and will launch the minesweeping boats, SeaCobras, MEDEVAC helos, the air assault for the attack on the airfield, etc. when called to do so. The destroyers will provide NSFS to suppress enemy artillery ashore and for other missions when requested to do so. If a suspected Silkworm launcher is detected, TARPS, SOF, or Satellite must identify it before it can be destroyed. Silkworm and SAM sites require a coordinated laser

designation in order to achieve a perfect attack. A Silkworm launcher detected at the northernmost site threatens the CVBG, and one at the southermost site threatens the ARGs. SAM sites protect the port and airfield.

4. (FOUO) FIRST TASK ASSIGNMENT CLF. On order of the JTF 1, land two AAAV-mounted companie on Red Beach and Blue Beach concurrently. Simultaneously seize commanding terrain to the north of Red Beach with one heliborne company. Once the beach and commanding terrain are secure, attack along the roads from the beaches to the port and airfield with the AAAV-mounted companies, clearing minefields with the attached Engineer Platoon, killing counterattack forces with assigned Cobras and conducting MEDEVACS as necessary. Once the roads have been cleared, conduct a simultaneous coordinated attack on the port and airfield with your AAAV-mounted companies and your heliborne companies.

(FOUO) SECOND TASK ASSIGNMENT CVBG. Support the CLF and subordinates by launching requested assets and providing fighter support.

7. (FOUO) THIRD TASK ASSIGNMENT ARG. On order of JTF 1, ARG will initially clear mines from the beaches with the Minesweeping Boats. ARG will launch 3 Companies of Marines for the initial assault on Red and Blue Beaches and the hill. The ARG will launch the Cobras, MEDEVAC helos, the heliborne company for the attack on the airfield. ARG will also, with NSFS DDGs, suppress artillery positions.

8. (FOUO) COORDINATING INSTRUCTIONS.

A. (FOUO) This order effective for planning upon receipt and execution on order.

B. (FOUO) Dirlauth for planning and operations with Info CJCS and CINCMED.

C. (FOUO) ROE will be per CINCMED OPLAN 1234.

D. (FOUO) Friendly forces will have a UAV (launched from the ARG) airborne for the duration of the operation. The UAV's will keep the artillery strong-points and the suspected FROG sites under constant surveillance, so that NSFS or CAS assets can be brought to bear immediately if needed.

E. (FOUO) If the airfield attack is held up for any reason, the port attack will be delayed to retain the synergism of concurrent attacks. If the port attack is held up, the airfield attack will go forward.

F. (FOUO) The attack on the airfield has priority, because enemy buildup/sustainment of forces can be most quickly and effectively achieved through air transport.

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GENTEXT/ADMIN AND LOG/

7. (FOUO) Per CINCMED OPLAN 1234, as amended herein.//

GENTEXT/COMMAND AND SIGNAL/

8. (FOUO) USCINCMED is supported CINC.

9. (FOUO) CJTF 1 is on-the-scene Commander and will exercise OPCON of advance forces until HQ USCINCMED FWD is activated.

10. (FOUO) Command relationships as outlined in Annex J, CINCMED OPLAN 1234.

11. (FOUO) Communications guidance as outlines in Annex K, CINCMED OPLAN 1234 as amended herein.//

AKNLDG/Y//

DECL/OADR//

APPENDIX E. CHANGES MADE TO THE PARAMETRIC DATABASE

The following changes were made to the parametric database. The parametric database can be launched from a standard MDS login (see Appendix F) by right click the mouse and selecting APPLICATIONS -> PARA EDITOR. For more information on editing the parametric database, contact Mac Garrabrants, Project Manager, Modeling and Simulation, VisiCom Labs. [Ref. 3].

A. LAND MINES

Only the lowest density of mines were used. Additionally, the removal settings were changed to 1 minute per man per square meter of mines, and a maximum work crew of 1000. These changes were made to facilitate mine removal by the engineers. At the default settings, removing a small minefield can take hours. By increasing the personnel in a standard engineering squadron, the removal time be lowered even more to meet the needs of the A2C2 scenario.

B. BRIDGES

Like land lines mines the removal time was set to 1 minute per man per square meter. The min work crew was set to 20, and the max crew was set to 200. The numbers can be varied. The more units working on the bridge removal in a coordinated effort, the more rapidly the bridge can be removed.

C. DEFAULT TERRAIN

The default terrain settings were set to allow all units to move at the fastest speed possible. These settings, in conjunction with the move and speed override commands will allow units to move in a predictable manner over any terrain.

D. SHIP MAXIMUM DETECTION RANGE

In order to detect sea mines, the maximum detection range on ship used in this experiment was set to 8000 meters. This setting is only useful if the sea mines capability is implemented in the MTWS version of the scenario. A sea mine removal technique was not developed because of time constraints.

APPENDIX F. STARTING MTWS

The following are startup procedures for MTWS. A system administrator who is knowledgeable about HP UNIX operating systems should be available for any operating system specific issues.

A. BEFORE LOADING MTWS

All of the computer workstation on the MTWS network that are to be used in an exercise should be powered on prior to loading MTWS. There are three types of computer terminal that are used in an MTWS network that must be present before an MTWS simulation can be loaded and run.

1. MTWS System Control (MSC)

This is the system that is the primary interface that is used to create, load, and control MTWS exercises.

2. MTWS Application Network (MAN)

There can be multiple MAN stations on an MTWS network, but for an exercise the size of the A2C2 scenario, only one is necessary. The MAN stations control the actual simulation of the scenario. In the case of larger exercises using multiple MAN stations, each MAN will execute a particular set of computations apply to specific aspects of the scenario, such as Air operations, ship-to-shore operations, or ground movements. The MAN stations are

configured through the MSC, so human interaction is required with the MAN terminal except to power them on and off.

3. MTWS Display Station (MDS)

The MDS stations are the primary interface between the MTWS simulation and the participants of an exercise. Most exercises will use multiple MDS stations including A2C2. The MDS station displays the map layout of the scenario, and provides the means for the MTWS operators to enter commands that direct units.

B. STARTING MTWS

1. Start MSC

The user needs to know the correct user ID and password to log on to the MSC. These should be available from the local network system administrator. Once the MSC is logged on, the should click the right mouse button on an area of the screen that contains no windows or icons. A menu will appear, and the user should select APPLICATIONS -> START SYSOP -> MTWS.

Three windows will appear including the MTWS Sys Ops window. In this window, select the SYSTEM CONTROL-> ADMIN -> START MSC menu option. Wait until the MTWS Sys Ops window indicates that the MSC has started.

2. Load MAN

In the MTWS Sys Ops window, select SYSTEM CONTROL -> APPLICATIONS -> LOAD MAN. A window entitled Man Hosts

appears, and displays all the possible MAN stations that could be used. For A2C2 only select MAN001. Press the OK button in the MTWS Sys Ops window. Wait until the MTWS Sys Ops window indicates that the MAN has loaded. In the meantime, the MAN station(s) should automatically logon, and a series of windows and icons will appear.

C. LOADING OR CREATING AN EXERCISE

At this point in the MTWS loading process, the user will have the option to either load an existing scenario, or create a new one.

1. Creating an Exercise

To create an exercise, select the EXERCISE CONTROL -> DATABASE -> EXERCISE -> CREATE menu option in the MTWS Sys Ops window. The exercise configuration window will appear. The user should enter the appropriate information. After an exercise has been created, follow the procedures in the next section to load the exercise.

2. Loading an Exercise

In the MTWS Sys Ops window, select the EXERCISE CONTROL -> DATABASE -> EXERCISE -> LOAD menu option. The user should wait until the MTWS Sys Ops window displays the message saying the the exercise and terrain load are complete.

Next, the system CONTROL -> APPLICATION -> START APP menu option should be chosen from the MTWS Sys Ops window.

MTWS will display a message when the application has successfully started. At this point, the user is ready to start playing or configuring the MTWS exercise.

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1. Benson, Robert E. "Conduct and Assessment of A2C2 Experiment 3 and Guidelines for Future Experiment", NPS Thesis, June 1998.

2. Cubic Applications, Inc., "Vision XXI - MTWS User Reference Manual", April 1998.

3. Mac Garrabrants, Project Manager, Modeling and Simulation, VisiCom Labs, Inc, San Diego, California

4. MTWS Training Handbook, Visicom Labs, San Diego, California, 1995.

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6. Daniel Serfaty, Aptima Inc., "Adaptive Architectures for Command and Control (A2C2) Research Plans (Version 1.1), June 1997.

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